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ANCIENT LOCOMOTIVE ENGINES.

BY HERBERT T. WALKER.

In these modern days, when transportation by steam is so cheap, rapid, and luxurious, and when railways are now so far a necessity of our lives that if their traffic was stopped to-day existence would soon become impossible, it is not easy to realize the stupendous difficulties and discouragements the early railway engineers had to contend with, not only in the introduction of the locomotive itself, but in the initial trouble of overcoming the dense opposition of the people as well as the ruling classes of England, and of getting the legislature to permit a railroad to be built at all.

The earliest locomotives bore little resemblance to the magnificent engines of the present day. Their designers were naturally influenced by stationary engine practice, and, with few exceptions, they placed the cylinders in a vertical position, with either fly wheels or more or less cumbrous gearing between them and the driving wheels, while the boilers had but a single flue; consequently, the heating surface was small and they were unable to generate steam

(Continued on page 167.)

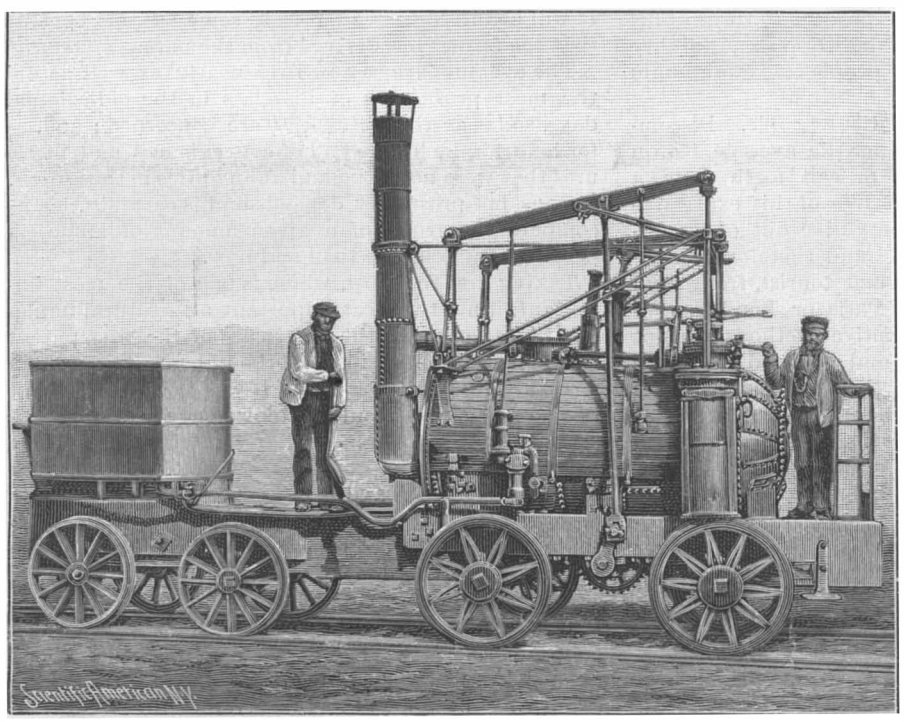


Fig. 1.—ENGINE "PUFFING BILLY," WYLAM RAILWAY, 1813.

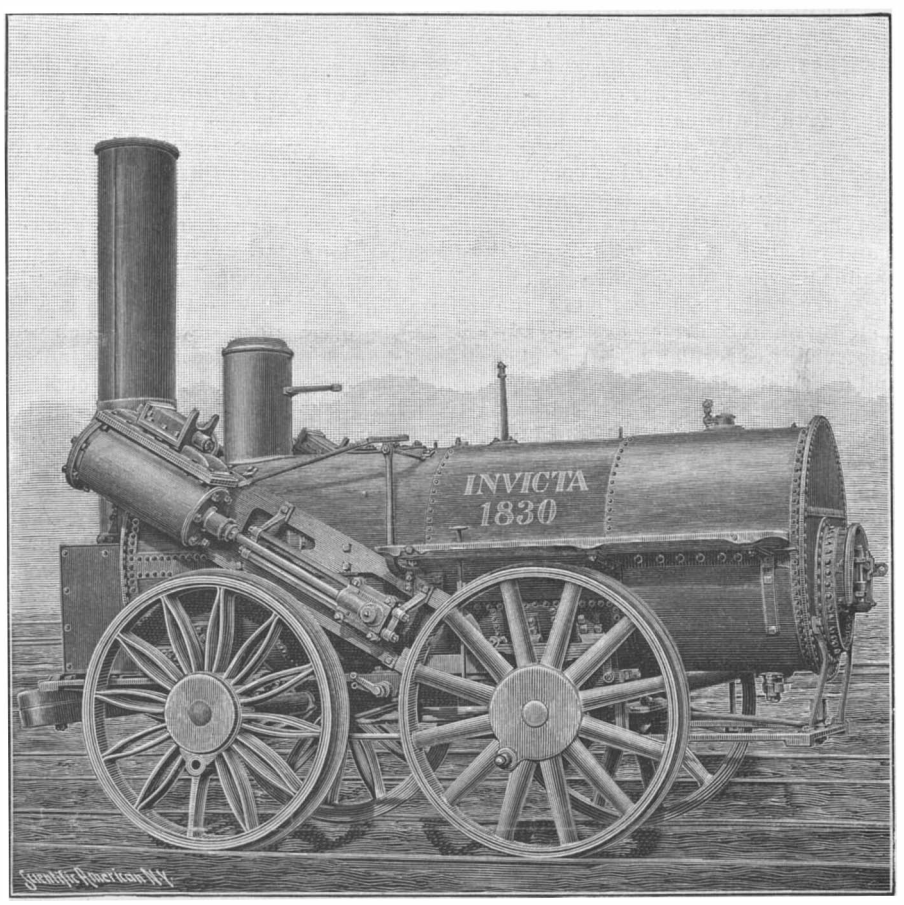


Fig. 3.—ENGINE "INVICTA." CANTERBURY AND WHITSTABLE RAILWAY, 1830.

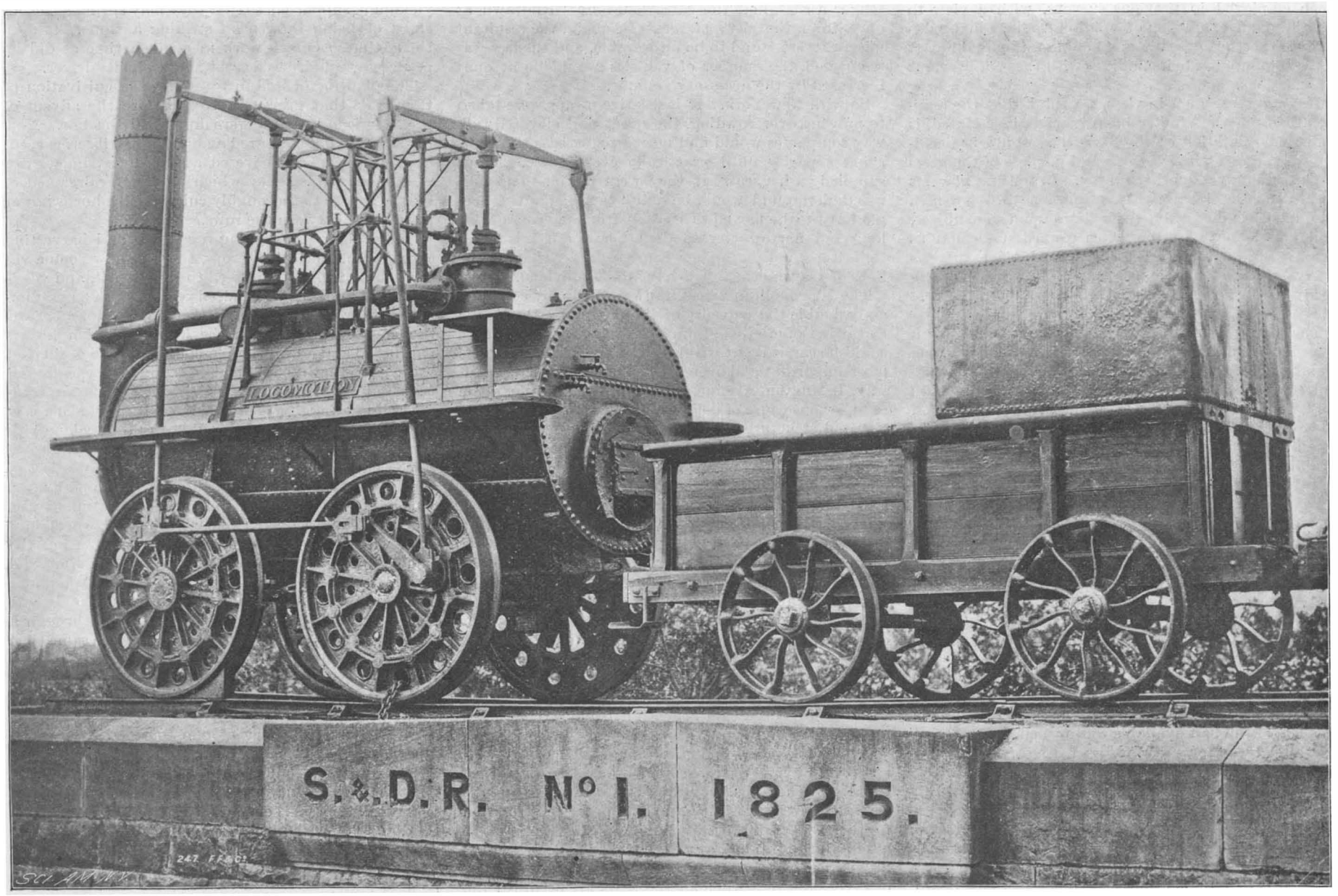


Fig. 2.—ENGINE "LOCOMOTION," STOCKTON AND DARLINGTON RAILWAY, 1825.

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SELECTION OF THE NEW CANAL COMMISSION.

Now that Congress has decided that the question of a canal at the Isthmus must be investigated in the most thorough manner, and in the broadest possible spirit, the selection of the board of engineers becomes a matter requiring the exercise of careful judgment. The fact that the people of the United States should demand yet another survey in spite of the fact that eight or nine previous surveys have been made simply proves that they realize the magnitude of the undertaking, and do not wish to be driven by mere sentiment or impulse into a venture of which the physical merits and demerits and financial liabilities are only imperfectly known.

In comparing the several surveys that have been made, there is one disquieting fact which, perhaps, more than any other, has led Congress to pause before committing itself to the construction of the canal, and this is the wide disparity which appears in the estimates of the practicability and cost of the various proposed canals, and particularly of that at Nicaragua. Between the estimate of $65,084,176 by Menocal and the estimate of $150,000,000 by General Hains there is a disparity so great as to satisfy Congress that at the present stage the surveys are in no such condition as to warrant it in taking up the work of construction, or even sufficient to allow an intelligent comparison to be instituted between this and the apparently more feasible Panama route.

The authorization of yet another survey, and the placing of the large sum of $1,000,000 in the President's hands for the purpose, show that it is the wish of the country that this examination shall be thorough, impartial, and final. It is desirable that the new board should be composed of engineers who have never yet been employed in previous surveys, with a view to obtaining an expression of opinion from as many different experts as possible and enabling the final report to be compared as to its findings with those of previous commissions.

Having these facts in view, we think that the reappointment of the Walker board, which, it is stated, is under consideration by the Executive, would be decidedly at variance with the spirit and purpose of Congress in demanding yet another survey. In the first place, it would narrow down the investigation to a few men who have already given their views upon the subject, and have shown a strong bias toward one canal as against the other; and in the second place, there is every evidence that the members of this board are already widely at variance in their views upon the cost of the Nicaragua scheme itself.

The country has asked for a new survey, not for a rehash of an old one; and in view of the fact that one member of the board, Prof. Haupt, has said in committee, "After my investigations as to the economies that would be effected by this (the Nicaraguan) canal the question of cost does not carry very much weight in my mind, even if it were $200,000,000," we think the desirability of securing entirely fresh material on the new board is evident.

Bearing in mind that the threefold interests, military, naval, and commercial, are interested, we think that the appointment of a board consisting of three engineers from the army, two from the navy and two from civil life, none of whom has been concerned in the previous surveys, would best meet the needs of the case and comply with the wishes of the whole nation.

As matters now stand, four out of the five members suggested for the new board have served on the old commissions, and three of them are committed to the construction of the Nicaragua Canal. Of what value will the report of such a commission be in solving the problem of the best available route when its members are already notoriously pledged to one particular route? If the President is desirous of fulfilling the clearly expressed wish of Congress, he will appoint an entirely non-partisan commission, or one which includes a commissioner representing officially the interests of each canal. How comes it that in selecting a board whose avowed object is to examine the relative merits of Panama and Nicaragua, the new board has been filled with partisans of Nicaragua, while those of Panama have been ignored altogether? Has the Executive any doubt of the fitness of General Abbott, U. S. A., one of the most experienced engineers in the world, or of Chief Engineer Fteley, under whose care the great Croton undertaking is being successfully completed? We sincerely hope that the admirable judgment which has hitherto characterized the actions of the Executive will not be clouded at this late hour by such obvious partiality as is shown in the proposed make-up of the new commission.

TO PREVENT CROWDING ON STREET CARS.

There are some things in which New York city leads the world, and one of these is the art of overcrowding. There are residence areas of the city in which more souls are to be counted to the square mile than in any other quarter of the globe; there are thoroughfares down which a more solid stream of humanity surges at certain hours of the day than can be witnessed in any city of the old or new world, while in the matter of transportation we have developed overcrowding into a fine art. There is certainly no city that can touch us in this last respect; for by virtue of that skill which comes only by patient study and long, if painful, experience, the average New Yorker in a crowd is an adept in adjusting the irregularities of his body to conform with as little discomfort as possible to those of his neighbor. As a result we lead the world in our ability to jam a maximum number of people into a minimum amount of car-space.

We are certainly a most patient people. Discomforts of travel which would render the average Briton apoplectic with indignation, or call forth from a Frenchman the choicest expletives of his expressive language, are accepted by ninety-nine out of a hundred Americans as irremediable and therefore inevitable. Occasionally some returned tourist, fresh from the "seat for all" methods of Paris or London, ventures to ask why some restrictive methods are not taken to prevent our street and elevated cars from carrying more passengers than they can seat; but he is immediately met by the statement that Americans are too busy a people to wait for a seat, and prefer to travel standing if they can not start at once.

The fallacy of this reply is obvious to anyone who has seen both systems at work; for while it may happen that occasionally in the cities named a passenger has to wait a few minutes for a vehicle with a vacant seat, in the vast majority of cases the first car or bus that comes is available. This fact is explained by the great law of supply and demand, the various transportation companies placing more cars upon the routes as fast as they are required. If the authorities of Paris, deciding to return to the barbarism and brutalities of overcrowding, rescinded the law insuring every passenger a seat, half the cars would be withdrawn at once from the city's streets. If, again, the resultant miseries were found to be unbearable, and the law was re-enacted, the number of vehicles would be at once increased by the necessary amount.

So with New York. If legislative means were taken to prevent overcrowding, the street and elevated railway companies would find means to increase their carrying capacity until practically every passenger was supplied with a seat. If they were unable to do this, the underground would be built at once; for the people have to be moved twice daily from one end of our long and narrow city to the other, and if it is found that it cannot be done with decency by the existing lines of travel, others will have to be provided.

The Metropolitan Street Railway Company could exactly double the capacity of its system by the simple expedient of double-decking its cars, a change that could be carried out within a few months' time on its most important and overcrowded lines, such as Broadway, Lexington Avenue, and Madison Avenue. The most serious cause of delay would be the raising of the elevated structure some four or five feet at the few points where the Metropolitan tracks on these lines pass beneath those of the elevated—a change that could be made at an insignificant cost, compared with the vast relief afforded to the traveling public.

By directing long distance passengers to take the upper deck of the cars and reserving the lower deck for "short haul," the delay of loading and unloading passengers would be greatly reduced, the passageways being free and the passengers being able to move without delay from their seats to the platform. This change could be made within a few months on the lines in question, and within twelve months the raising of the elevated structure on Third, Sixth, and Eighth Avenues, at the points where at present it would not admit double-deck cars beneath it, could be completed and the cars running.

It would be a costly undertaking for the roads concerned, but not nearly so costly as the franchises granted to these roads by the city are valuable and deserving of every possible return in the way of provision for the comfort of the traveling public.

The Harburger bill, at present before the Assembly, provides that the cars shall carry no more than they can seat, and that when all the seats are occupied the entrance gates shall be closed. Such a procedure is impracticable and too radical, and it would prove disastrous if put rigorously into practice. During the rush hours, with the present number of cars in use, many of the downtown passengers would have to wait from a half to a full hour before they could get the coveted seat. At the same time we think that some less drastic measure in the way of a "no seat, no fare," or "no seat, half fare," enactment would hasten the introduction of the two-deck car or the construction of the underground road. Certainly the two-deck car should be given a thorough trial. It is in practical use in a number of European cities and gives very general satisfaction.

THE FARMER AND THE PATENT SYSTEM.

Until recently that numerous and influential class of our citizens, the farmers, have in some sections of the country borne a feeling of enmity toward the patent system. There is no doubt that this feeling arises from an entire misunderstanding on the part of this intelligent class of our citizens as to the aims and purposes of the patent laws, and that this feeling of hostility has been engendered and increased by the unscrupulous acts of certain parties who have taken advantage of the protection of the patent laws to levy a species of blackmail upon the unsuspecting farmer. It will be interesting to review some of the benefits that the farmer has derived from the patent system.

The average farmer now lives nearly as well as did the most prosperous of his class in the old colonial days, so far as the necessities are concerned; and, as for luxuries, he has no end of conveniences and pleasures that were not to be had at any price in those days. But, as his prosperity depends on his earnings, let us compare the fruits of a given amount of labor expended in agriculture then and now.

Taking first the plow, which is one of the most important, if not the most important agricultural implement, at the time of the enactment of the first patent law in this country, in 1791, the plow was a wooden structure shod with iron, and it was so imperfect that but an acre of land could be plowed in a day, and even then it was not much more than scratched. The plow had hardly been improved at all in forty centuries. Now, the steel plow, with its greater strength and its perfected shape, digs down and overturns the soil so that a much larger crop is grown, and several times as much work can be done in a day with the ordinary one-horse plow as with the old form; while a steam-driven gang glow can plow twenty acres in the same length of time.

The harrow of the eighteenth century was simply a log having the spurs of its limbs for teeth. It was ineffective and easily broken. The modern harrow is mounted on wheels, and its well-shaped steel teeth are yieldingly supported, so that they may spring aside, instead of being broken on striking a stone. It does thirty times as much work in a given time as did its predecessor, and, besides this, it carries its driver.

The planting of seed in rows and the cultivation of the plants that grew therefrom before the advent of the American inventor were done with the hoe. Now the seed, with a measured amount of fertilizer, is accurately deposited and covered as rapidly as horses can walk; and implements which were never dreamed of by our ancestors thoroughly cultivate by horse power the ground between the rows.

Of machinery for digging vegetables and harvesting corn, grain, and other crops, there is now such a variety that one is embarrassed to describe it, and yet it was all unknown one hundred years ago. The best implement for harvesting grain three generations ago was the cradle. This is a scythe having wooden fingers parallel to and above the blade to catch the grain as it was cut, so that it could be laid straight on the ground for ease in gathering it. A single man using a modern self-binding harvester will cut and bind twenty times as much grain in a day as he could cut alone with a cradle. These machines are sold for about the same price as a high-grade bicycle.

In thrashing by the use of the flail, which many persons living can remember to have seen in common use, four men could thrash twenty bushels of wheat in a day; while the steam thrasher of to-day, using the same number of hands, can thrash one thousand bushels in an equal length of time. In fact, there are steam-propelled harvesting machines on the Pacific slope that cut a swath twenty-six feet wide through a field of wheat, and the same machine at the same time thrashes, cleans, and puts the grain into bags at the rate of three bushels per minute; yet seven are all the men that are needed to run such a machine.

The prototype of the mower is the scythe, which has a comparative efficiency of one to twenty; and one modern horse rake is equal to half a dozen field hands working with the hand rake, which was the best implement the last century afforded.

The baling press is entirely an invention of this century, and yet, without it, hay could be profitably raised only near enough to the cities to be hauled in wagons, for it could not be shipped by railroad economically in its loose state.

In fact, there is so much machinery in use by the farm-

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er of to-day for doing work that was done largely by hand before the advent of the patent system that this article would be altogether too long if all of even the principal instances were mentioned. While the farmer of the Revolution did most of his work by the unaided use of his hands, the farmer of the present time works by his brain through machinery which he has only to guide and to watch and most of which saves him the trouble even of walking.

This substitution of machinery for hand labor on the farm has relieved the farmer of other burdens than the mere drudgery. The use of hand labor before the patent system compelled the employment of a large force of laborers. Our comparatively short seasons required that the greater part of the force should be gathered in the spring and discharged in the fall to save wages through the long winter. It was with difficulty that men could be found at the desired time, and those of entirely unknown antecedents were gladly hired. This force was idle at intervals and again it required a considerable temporary increase. These men had to be housed and fed, necessitating the employment of female help, which is at all times difficult to secure in the country.

On the other hand, the introduction of farm machinery increased the power of a man to work to about ten times what it had been with hand tools, resulting in a great reduction in the number of hands necessary to operate a farm, and eliminating to a large extent the inconveniences of the larger force. Farm machinery is soon paid for out of the saving in wages and board which results from its use, and the cost of production is thus so greatly lowered that the American farmer is enabled to compete with low-priced hand labor in other parts of the world, while his profits at the same time are much increased.

The case is parallel to that of the shoemaker and the shoe manufacturer. The shoemaker can profitably make expensive shoes to suit fastidious customers, but he cannot compete with the almost equally good machine-made shoes of the manufacturer in supplying the masses. No profits in general agriculture can be made where intelligent American hand-labor is relied upon to the exclusion of machinery. It has been the experience of trades repeatedly that, so long as there is no way to produce an article but by hand, cheap foreign labor supplies our own market; but as soon as we begin to make it by machinery we not only drive out the imported hand-made production, but sell abroad at a lower price than that for which the manually produced article can be offered. In this country, the wages of hand-labor more than eat up the profits. It is only in gardening that such labor can be economically employed by the agriculturist. To make general agriculture lucrative by hand-labor, it is necessary to go where Chinese, negroes and laborers of similar races may be utilized.

We cannot stop with the farm machinery, however, in enumerating the inventions produced since the patent system was introduced which benefit the farmer. When grain is hauled to the railroad, it is deposited in the cars or in the storage bins of the warehouse by a single movement of a lever; and at the great elevators of the large cities an entire train of cars will be loaded or unloaded in a single hour, thus doing in a small part of the time the work of an army of the shovelers of former days.

The modern mills make better flour and make it at a fraction of the cost of the last century; so that, as it is cheaper as well as better, a much enlarged demand is created for the grain from which it is made.

The dairy and canning machinery now in use not only replace an enormous amount of manual labor, but, by quickly converting the perishable milk into cheese and butter and by preserving the fruit and vegetables, they render profitable the raising of these products without reference to the distance from the cities. This was not formerly possible, because such forms of produce as these would spoil while being hauled to the market in wagons. The same advantages have accrued from the slaughtering machinery and refrigerator and stock cars with reference to the raising of live stock for meat.

Modern methods of refining oil and improved lamps have produced a light that is many times more brilliant than the old tallow dip of our forefathers and that is almost as safe.

The railroad is of the greatest service to the farmer, and here, too, the patent system is most intimately connected with its institution and development. The railroad ships live cattle and perishable fruits and vegetables from distances that would be impossible with the old methods of transportation, because such products would perish on the way, and, besides carrying more stable products, it brings the farmer his implements and fertilizers. In fact, if he had to haul all of his products by wagon, many large areas in this country could not be worked, because they are so far from the markets that the cost of shipment in the old way would be prohibitive. The railroad puts the farmer in touch with the consumer, no matter what distance may separate them. Indeed, the railroad and steel steamship open to the American farmer the whole world as a market. The steel steamer is much more economical than the wooden sailing vessel which it has supplanted, because it is several times larger, much safer, and faster than the sailing ship, and yet it requires a smaller crew and a shorter period of time to make a trip, resulting in a great saving of wages. The farmer gets the benefit of these differences in lower transportation.

Another invention which was developed under the fostering care of the patent system is the telegraph. By its use the farmer is often notified of the failure or probable failure of crops in other parts of the globe in time for him to supply the deficiency. Through the telegraph he is warned of storms which would destroy his herds in time to take them to shelter—a proceeding that requires many hours on the great stock farms of the West—and of frosts, so that he may protect his small fruit. The telegraph, by giving frequent reports of the supply and demand, serves to keep the prices of the farmer's merchandise uniform throughout the entire country, excepting for the cost of transportation. He also knows the daily fluctuations of prices in the markets, so that he may choose the most advantageous time to sell.

These instances of the economy resulting from the use of machinery show that the resources of the farmer of the nineteenth century, compared with the meager earnings of his eighteenth century ancestor, are, to a great extent, due to the machinery which is at his command and which his forefathers did not have.

That this machinery has ever been invented is largely due to our wise patent laws, which will be apparent from the following considerations: The machinery which the farmer now enjoys did not exist before the patent system, but has been devised almost wholly since its establishment. Those who drafted the Constitution, with that foresight that has so many times evoked admiration when viewed in the light of after events, included a clause which was intended to produce just this result. The farmers of no other country are one-half so well provided with labor-saving machinery, and no other country has had, or now has, a patent system equal to ours.

The farmer labored for many centuries without machinery, and the patent system was instituted for the purpose (among others) of supplying him with machinery. Almost immediately after the enactment of our patent laws, agricultural machinery began to be invented and improved, and as this progress has continued and has steadily increased, it is clear that the patent system is the cause of the existence of the farmer's machinery and, through it, of his affluence.

Most of these inventions would not have been made if it had not been for the protection of the patent laws. To bring an invention from the general idea in the inventor's mind to the practical, durable, salable form often requires the expenditure of years of effort and thousands of dollars before any returns are had; so that it is safe to say that very few would expend their energies and resources if it were not for the inducements offered by our patent system.

Congress concluded that the most equitable manner of rewarding the inventor was to give him a monopoly for a limited time of the manufacture, use, and sale of his invention. This monopoly induces him to labor untiringly to create an invention, to put it in the most practical form, and to introduce it as thoroughly as possible in order that he may get the largest possible amount of profit. If the invention is of little practical value, its sales will be small, while from an invention of great utility the inventor may, and probably will, reap large profits; but this is only for a limited time, after which the invention will become public property. The reward is thus in just proportion to the benefit which the public derives from the invention.

The manufacturer of farm implements, on whose head the resentment of the farmer is sometimes showered because of the supposed larger prices of the agricultural machines covered by existing patents, would be glad to be relieved from the danger of strikes to the extent to which the farmer has been emancipated by the machinery furnished by the patent system; for, if the farms of to-day, which are many times larger than those of the last century, were operated with the hand implements of those days, the labor problem would become as serious to the farmer as it is to-day to the manufacturer.

Seeing, therefore, how absolutely necessary is the patent system to the welfare of the farmer and to the country at large, he should instruct his representatives that the patent system is to receive their earnest support, and that time spent in so changing the patent laws and their operation as to give the strongest practical incentive to the inventor which is compatible with the greatest ultimate advantage to the public will be appreciated as highly as any other efforts he can possibly make.

EDWIN J. PRINDLE,
Assistant Examiner, United States Patent Office.

ABOUT thirteen years ago the first tank steamer was built, and there are now one hundred and eighty tank vessels in existence, nearly all of them being steamers. Their tonnage is 401,024.

DEATH OF JOHN KRUESI.

John Kruesi, the chief mechanical engineer of the General Electric Company, and one of the little band of men who worked with Mr. Thomas A. Edison at Menlo Park, N. J., died at Schenectady, N. Y., on February 25, 1899. He was born in 1843 in Switzerland, and went to work in a machine shop at an early date. He came to the United States in 1870 and was engaged by the Singer Sewing Machine Company. In 1872 he entered the employ of Mr. Edison and became associated with him when he later, in 1875, opened a shop for purely experimental work in Greene Street, New York. Mr. Kruesi became Edison's machine foreman, designing and making special apparatus to fit the conditions. From 1876 to 1881 Mr. Edison was busy with the phonograph, the telephone, incandescent electric lighting, electrical railway experiments, etc. The first phonograph ever constructed was made by Mr. Kruesi from Mr. Edison's rough sketch, and this instrument is now in the Patent Department of South Kensington Museum, at London. Mr. Kruesi made the machine and brought it to Mr. Edison, who set it going and spoke into it the now familiar "Mary Had a Little Lamb." When it started to repeat his words, he was almost awed when the machine actually repeated the rhyme in clear words, when at the best a hoarse murmur was expected. Mr. Kruesi remained with Mr. Edison and became one of his partners and assisted in laying out the conduits for incandescent lighting in New York city. Mr. Kruesi occupied important positions in various of the Edison companies and he was of great assistance in building the Schenectady shops; in fact, as they now stand, they are Mr. Kruesi's monument. He had charge of the Schenectedy works from 1892 until 1896, when he was appointed chief mechanical engineer of the company.

DEATH OF LIEUT. DASHIELL.

Lieut. Robert B. Dashiell, Assistant Naval Constructor, United States Navy, who has been for some years in the Bureau of Construction and Repair at Washington, D. C., died at his residence in Washington, March 8, at the age of thirty-eight years. Lieut. Dashiell was a native of Maryland, and was appointed a naval cadet in 1882. His record at the academy was one of the most brilliant in the history of the institution, and the promise which he gave for success in future life was more than fulfilled by his subsequent achievements. Lieut. Dashiell devoted himself to ordnance, and he soon became recognized as one of the brightest men in the service. We have already illustrated some of the important inventions of Lieut. Dashiell, such as the "Dashiell" breech mechanism, his gun mounts, and his ammunition hoist. His exceptional ability was recognized in his selection, while still an ensign, to install the plant at the Indian Head Proving Ground. Here he became exposed to all conditions of weather, and contracted malaria, from which he never fully recovered, and which was the real cause of his death. After completing his work at Indian Head, Lieut. Dashiell was transferred to the construction corps, and here, as elsewhere, he soon became an authority. He devoted himself to the study of dock construction and spent two years in Europe. The report he made has been adopted by the department as the basis for dock construction under his direction. The service has suffered a severe blow in the death of Lieut. Dashiell.

SPORTSMEN'S EXHIBITION.

The fifth annual exhibition of the Sportsmen's Association was formally opened at the Madison Square Garden on Thursday, March 2. The whole Fourth Avenue end of the building was occupied by a drop scene representing a Canadian glacier, which formed an appropriate background. The Indian village at the foot of the glacier added to the realistic effect, which was greatly enhanced by the big game which occupied a large portion of the floor space. Real Indians gathered around the camp fire and seemed to be thoroughly at home. The large central space was taken up by exhibits of various kinds, animals in cages, and the swimming tank, in which aquatic performances were given, including sensational high dives. Various displays occupied the space ordinarily taken up by boxes and arena seats. Here were exhibited guns, ammunition, animals' heads, skins, camping outfits, etc. Several railroads had miniature camps and guides. The live specimens of game were particularly interesting. Two handsome moose and a couple of buffalo were very much admired. From a scientific point of view, various launches and launch engines were the most interesting objects on exhibition.

NAVAL BUREAU CHIEFS.

Under the provisions of the new naval personnel law, the bureau chiefs of the Navy Department, who have heretofore been entitled only to the relative rank and pay of commodores, will have the rank and pay of rear-admirals of the second class, corresponding in grade and pay to brigadier-generals of the army. Chief Constructor Hichborn celebrated his advancement and his sixtieth birthday together.

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THIRTEEN-INCH GUN FOR THE "KEARSARGE."

As far as the body of the new 13-inch gun for the "Kearsarge" is concerned, there is very little difference observable as compared with the 13-inch guns of the "Oregon." It is generally similar in its construction as far as the tube, jacket, and hoops are concerned. The improvements, which are many and very valuable, are in the direction of greater convenience of handling and rapidity of fire.

If this gun be compared with one of the older type 13-inch, it will be seen that the greatest changes have been made in the breech-mechanism and in the mounting. The older gun was mounted directly upon its carriage by means of trunnions which were formed upon the gun itself, and recoiled with it upon firing. The new gun is mounted and slides within a large cylinder or sleeve, as shown in the illustration. This sleeve is provided with trunnions which are journaled upon the gun mounting. When the gun is fired it recoils within the sleeve, its movement being controlled and the gun brought gradually to rest by means of four recoil cylinders which form part of the sleeve, and are placed two above and two below the gun. The piston rods are attached to four lugs on a massive ring which is shrunk on the breech of the gun. Consequently, when the gun is fired the pistons recoil with the gun, the cylinders remaining stationary in the sleeve. The recoil is controlled by a set of powerful coil springs within the cylinders and at the back of the pistons, aided by the resistance of a mixture of glycerine and water, which flows past the pistons by means of a series of longitudinal grooves cut in the walls of the cylinders. The grooves are so arranged that the flow of the fluid is gradually throttled as the gun recoils, thus bringing the great mass of sixty tons to rest without any sudden shock. Although the gun starts on the recoil with an energy of 33,627 foot-tons, it is brought to rest within a distance of 40 inches. Glycerine and water are drawn in after the pistons during the recoil and are shut in by a valve when the recoil is completed. When the valve is opened the elasticity of the coil springs serves to force the gun slowly back to its firing position in the sleeve.

The sleeve is made in halves for convenience of manufacture, and is strongly bolted together as shown in the engraving. The gun is turned and finished with great accuracy, and slides upon special wearing surfaces consisting of several rings of metal which are recessed and hammered into the interior surface of the sleeve and then carefully bored to size. Other important improvements tending to rapidity of fire have been made in the breech-mechanism.

In the first place, the breech-block has six equal channels cut through the thread, as against the four channels which were common in earlier guns; and hence it is only necessary, in unlocking the breech, to give the block one-twelfth of a turn, as against one-eighth. In the new mechanism, the three operations of rotating the block, withdrawing it onto the tray, and swinging the block and tray aside clear of the breech, are performed by the continuous rotation of a single crank at the side (in our engraving the left side) of the breech.

The construction and operation are as follows: The crank and shaft, which are carried by a bracket bolted to the breech, serve to operate a worm which engages a worm-wheel at the top of the hinge-shaft of the breech-block tray. Below the worm-wheel is another wheel, which in the first part of the rotation of the hinge-shaft acts as a worm-wheel on a circular worm-rack on the breech-block, rotating the block. The instant the rotation of the block is complete the same worm-wheel acts as a gear-wheel on a horizontal rack attached to the side of the block and withdraws it from the screw box onto the tray. As soon as the block is clear of the box, the continued turning of the hand-crank traverses the tray and block to the left, clear of the breech.

This improved mechanism has reduced the time and labor of these big guns to a very marked extent. At an official test of a 13-inch gun fitted with the Fletcher mechanism, as it is called, the breech was opened in 8¾ seconds, and all the operations of opening breech, loading and firing were executed in 1 minute 47 seconds. This is a reduction of nearly fifty per cent as compared with the older guns.

The 13-inch guns for the "Kentucky" and "Kearsarge," if fired with brown powder (smoke-producing),



A "MAGIC" MIRROR.

have a muzzle energy of 33,627 foot-tons. If smokeless powder is used, they will have a resulting energy at the muzzle of about 44,000 foot-tons. As a very satisfactory smokeless powder is now being made for the navy, it is not likely that any of the obsolete brown powder will ever be taken into the magazines of these new ships.

JAPANESE MAGIC MIRRORS.

The ladies of Japan use, in making their toilet, a small round mirror, several inches in diameter, made of a kind of speculum metal, brightly polished, and coated with mercury. At the back there are various devices, including Chinese and Japanese written characters, emblems, landscapes, etc. These stand out in bright relief and are polished like the front surface. Now, if the direct rays of the sun are allowed to fall upon the face of the mirror and are then reflected on a screen, in many cases, though not in all, the figures at the back will appear to shine through the substance of the mirror as bright lines upon a moderately bright ground. These are so-called Japanese "magic" mirrors, but we believe they are found in China as well, and the example which we illustrate is surmised to be of Chinese origin.

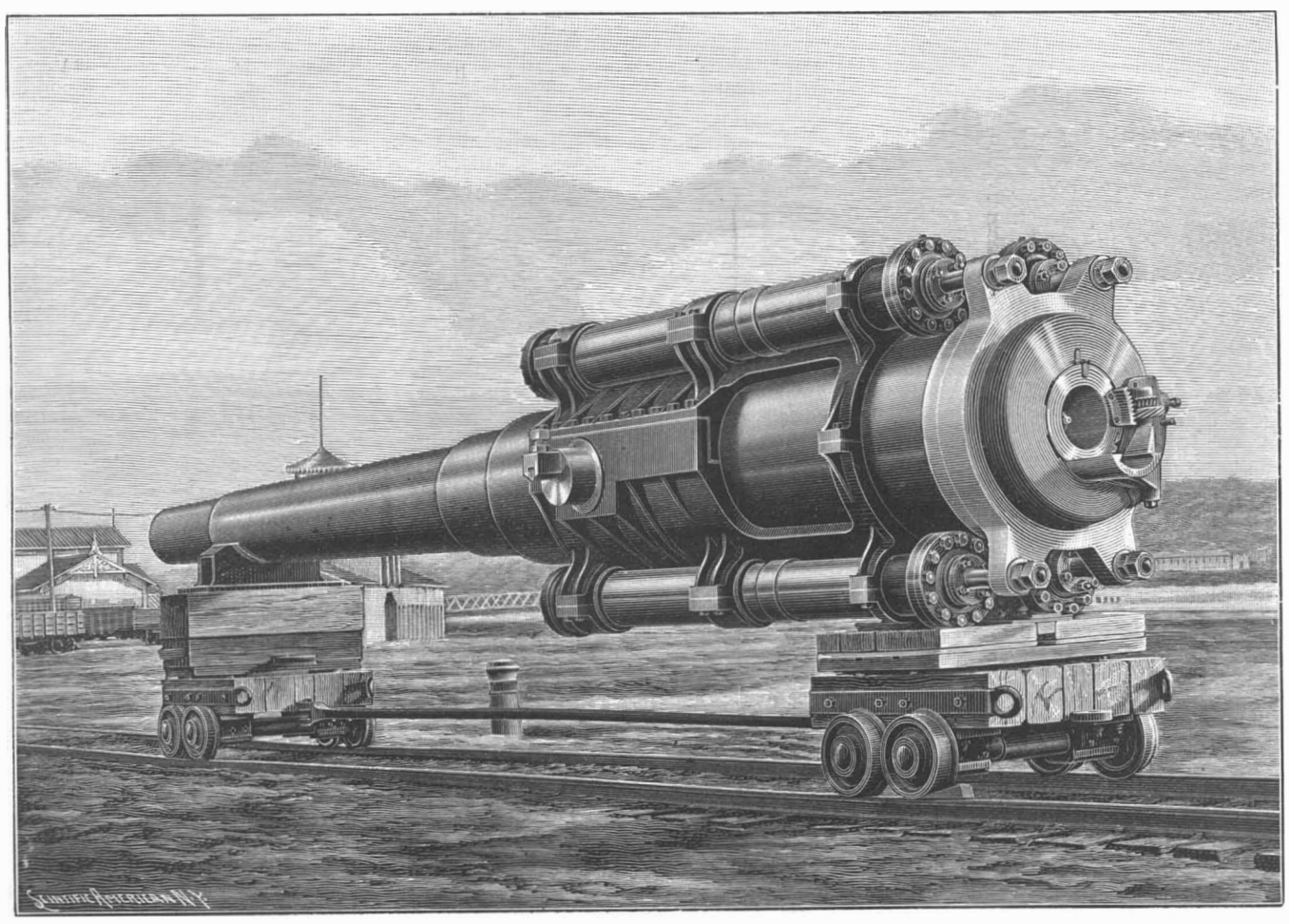
There have been many theories as to the process of endowing mirrors with the peculiar property we have mentioned. Some writers consider that the pressure to which the mirror was subjected during the polishing, and which is greatest on the parts in relief, was concerned in the production of figures. If the back of the mirror is rubbed with a blunt-pointed instrument, bright lines appear in the image corresponding to the position of the part rubbed. This experiment is quite easy to repeat. It would seem as if the pressure on the back during polishing would cause some change in the reflecting surface corresponding to the raised parts whereby the amount of light reflected was greater, or supposing that of the light which falls upon the surface a part is diffused and the rest concentrated, those parts corresponding to the raised portion on the back are altered by the pressure in such a way that more light is reflected, and therefore a bright image appears. The theory now generally accepted is that of Professors Ayrton and Perry in 1878. They showed that the patterns seen in the reflection were due to differences in the curvature of the surface produced by bending and subsequent polishing. Warming a mirror also alters its possibilities. A thick mirror which gave no patterns when cold sometimes developed one upon being heated. Professor Thompson has shown that a glass mirror having a pattern cut on the back developed image properties when the mirror was bent. By using very thick glass, passing a spirit lamp behind a strip of mirror, a dark band may be caused to pass along the screen, illuminated by light reflected from the mirror. Professor Thompson has also found that Japanese mirrors which were not image mirrors when imported could be made so by bending them mechanically so as to make them slightly convex.

Japanese mirrors are made as follows: The mould, which consists of two parts, is constructed of clay mixed with levigated powder of a black stone and a little charcoal powder and water, until the paste is plastic and suitable for being moulded. It is then roughly formed by the aid of a wooden frame into square or round cakes. The surface of the latter is covered with a levigated half-liquid mixture of old crucibles which have been broken and powdered. The blackish paste in the frame receives the concave designs by the aid of a woodcut in relief. The parts of the mould are put together in the frame and dried. Several of these moulds are then placed in a melting box made of clay and the fragments of broken crucibles. This box on the top has an opening into which the liquid bronze is poured. The liquid metal fills the moulds and the gates are chipped or broken off in the ordinary way. For mirrors of the best quality the following mixture is used:

Lead	5 parts.
Tin	15 "
Copper	20 "
	40 parts.

After being cooled the melting box and the moulds are crushed and the mirrors are taken out. They are then scoured and filed until they are roughly finished, and are then polished with a levigated powder formed of a soft kind of whetstone; they are then polished with charcoal and water. When the surface of the mirrors are well polished they are covered with a layer of mercury amalgam consisting of quicksilver, tin, and a little lead. The amalgam is rubbed vigorously with a piece of soft leather, which manipulation must be continued for a long time until the excess of mercury is expelled, and the mirrors have a fine, bright, reflecting surface.

We are indebted to Harry Hales, of Ridgewood, N. J., for the use of the mirror which we were enabled to photograph. The mirror is 6⅝ inches in diameter; the handle is 3½ inches long; and it weighs ⅝ of a pound.



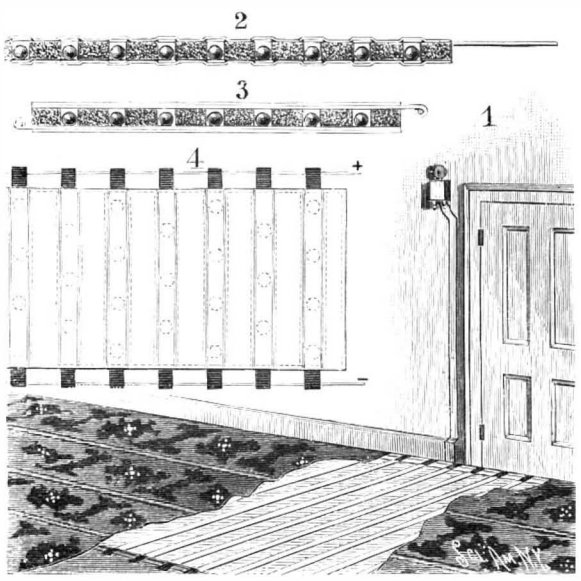
THIRTEEN-INCH BREECH-LOADING RIFLE OF THE "KEARSARGE."

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AN ELECTRICAL ALARM-MATTING.

A novel burglar-alarm has been invented and patented by Arthur DeF. Risley, of Richfield Spa, N. Y., which consists of a simple and inexpensive electrical matting placed under the carpet of a room.

Fig. 1 shows a portion of a room with the matting in place; Fig. 2 is a longitudinal section of the matting;



RISLEY'S ELECTRICAL ALARM-MATTING.

Fig. 3 a transverse section; and Fig. 4 is a top plan view.

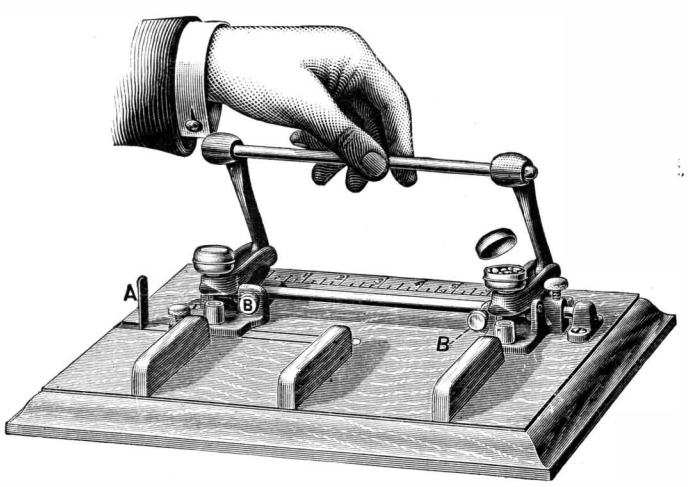
The matting consists of an elastic non-conducting fabric which, as shown in Figs. 2 and 3, is provided with a series of alined orifices. On both the upper and lower sides of the orifices conducting-strips are arranged, which are connected, as illustrated in Figs. 3 and 4, with the terminal conductors of an electric alarm circuit. Within each of the pockets formed by the orifices and conducting strips, a shot is placed.

When the matting is in use, the shot will rest upon the lower conducting-strips, but will be held out of contact with the upper conducting strip by reason of the thickness of the elastic non-conducting fabric. If the matting be stepped upon so as to compress the elastic fabric, one of the upper conducting strips will be brought into electrical contact with a shot, thereby closing the circuit and sounding the alarm. As soon as the pressure is removed the elastic fabric will raise the upper conducting strip out of contact with the lower conducting strip, thus breaking the circuit.

The invention, it will be observed, provides no springs to return the upper strips to their normal positions; for such springs are apt to bend and produce a constant contact. The matting can be made of the same thickness as the paper matting ordinarily placed under carpets. When, therefore, a section of paper matting is removed, and the alarm matting substituted therefor, no trace of the change can be observed in the carpet.

AN ADJUSTABLE PAPER-PUNCH.

Finding a considerable call, in connection with their post-binders and order-holders, for a device which would punch two holes at once, in order sheets, correspondence, or forms of all sorts, for which the post-binders are used, the Samuel C. Tatum Company, Cincinnati, O., have just got out a punch or file perforator as shown herewith.



AN ADJUSTABLE PAPER-PUNCH.

It will be seen that it consists of two levers, which are coupled together so as to punch the two holes at once. The special feature lies in the adjustability of the distance between the holes. In the machine illustrated this distance may be varied anywhere from 1⅞ to 7 inches. When paper-punching is to be done, the machine will be found a very valuable office help.

Besides the great amount of time taken to punch with an ordinary hand punch through a limited quantity of papers, there is, of course, the difficulty of getting any sort of register of distances, either from the margin or from one hole to the other, and this is accurately obtained in the device illustrated, which provides not only for a side gage, but also for a throat or margin gage; so that the distance from the margin can be exactly maintained, or, as the printers would say, made a perfect register. In the design special attention has been paid to the matter of durability, a feature in which so many other punches seem to fail.

The two cups set over the center, one of which is shown with the lid removed, catch all of the small disks removed from the paper, and avoid what would otherwise be a very annoying litter in using the punch.

Photographic War History.

The War Department has undertaken the compilation of a unique volume, a photographic history of the war with Spain. It has addressed a circular letter to all the officers in the service, asking them to contribute such prints, films, or negatives as they may have in their possession, promising to return such loans in good condition. It furthermore asks all officers to report the names of the persons known to have carried cameras in the region of active operations, so that their aid may be sought in compiling the volume. It is the desire of the department to produce in a single volume every obtainable feature and photograph bearing on the subject. Credit, of course, will be given to all contributors in the volume.

In the exciting campaign, both naval and military, the camera played an important part. By means of photographs the public became so thoroughly versed in the topography of Cuba and Porto Rico that they would recognize Morro Castle at the entrance to Santiago Harbor as quickly as the Narrows of New York Harbor. Although it is unusual for a government to undertake such a task, still it will tend to simplify the task of future historians, and such a work will prove of enormous importance.

A New Electric Clock Dial.

A Chicago inventor has recently patented an electrically illuminated clock. It seems practical, and is not very expensive to make. It is specially adapted for clock towers, and the idea is to illuminate the figures on the dial in turn, this end being obtained by the mechanism of the timepiece. Upon the hour hand is arranged a brush which travels in contact with a ring and segmental contact pieces, for the purpose of completing the circuit between the ring and each of the contact pieces in turn. By this arrangement the contact piece will be in circuit with the brush during one hour, or until the brush passes to the next contact piece, the actual lighting being effected by means of twelve electric lights, one behind each character. As soon as the hour hand passes the point midway between the two characters, the brush snaps down upon the next contact piece and throws the next lamp into circuit. The minute hand carries an electric light on the end of it, and the contact continues, so that the minute hand always indicates the exact minute by a single lamp, which is lighted continuously, whereas the hour hand uses twelve lamps in succession each twelve hours.

England to Study American Railways.

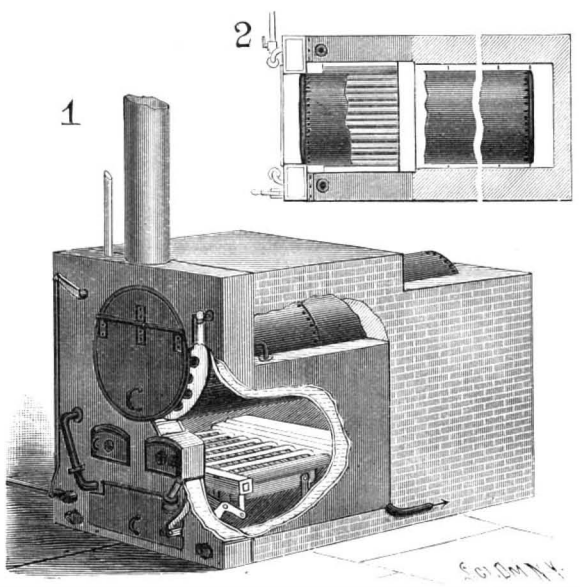
The British Railway Association has arranged to send five prominent railway officials to the United States to investigate the facts upon which the government bases the bill compelling the adoption of automatic coupling—a measure which would give the Board of Trade power, five years from its adoption, to compel British railroads to supply the whole of their rolling stock with this device, at an estimated cost of $50,000,000.

A WATER-HEATER FOR STEAM-BOILERS.

A water-heater has recently been patented by James T. Helms and Robert A. Keller, of Knoxville, Tenn., which is designed to supply steam-boilers with water heated directly by the burning fuel in the fire-box. As illustrated in the accompanying engraving, the water-heater forms part of the furnace of the boiler, and includes the furnace front, which supports one end of the boiler, and which is provided with a smoke-box into which the smoke-flues of the boiler open, and with a water compartment connected with a water supply, the water being automatically fed and cut off by means of a float in the compartment, which float operates a valve in the pipe. The sides of the fire-box are formed by water boxes connected at top and bottom with the water compartment of the front. The grate consists of front and rear transverse tubes, and of horizontal pipes connecting the tubes. The front tube is connected with the water compartment, and the rear tube with the boiler. The burning fuel heats the water circulating through the grate and the water contained in the front water compartment. The smoke and gases, after emerging from the smoke flues of the boiler, pass into the smoke-box, in order again to heat the water in the front water compartment. The water already heated in the furnace front passes into the water boxes forming the sides of the fire-box, and returns to the front water compartment. The water, after having been thus highly heated, finally passes through the tubular grate and enters the boiler at a high temperature. Whatever steam is generated in the water compartment can be carried off by a pipe to drive a condenser connected with the supply pipe.

In order to rake the burning fuel on the grate, an ingenious mechanism is provided, which consists of longitudinal rakes passing between the longitudinal pipes of the grate. The rakes are connected by means of links and bell crank levers with a lever fulcrumed on the outer face of the furnace front. When the lever is swung forward or backward, the bell-crank levers are actuated to impart an up-and-down movement to the rakes in order to rake the fuel.

The inventors claim that this water-heater will not only save fuel, but will prevent boilers' becoming coated with lime and other sediment, these impurities being precipitated before the water enters boiler.



A WATER-HEATER FOR STEAM-BOILERS.

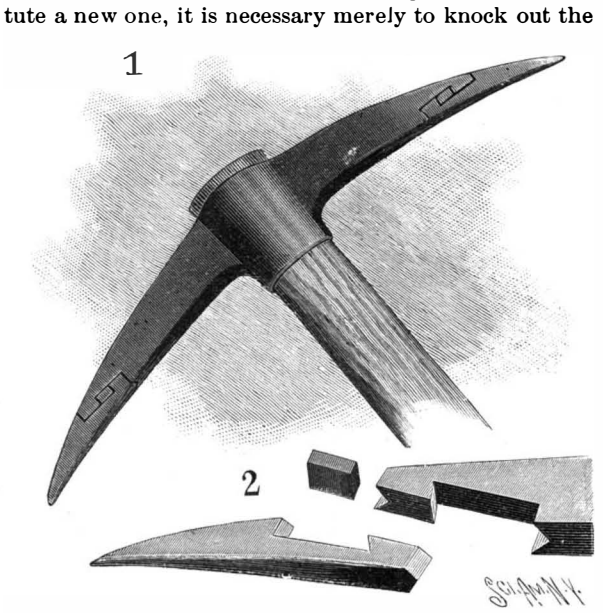
AN IMPROVEMENT IN PICKS.

Many a miner while prospecting has, no doubt, often been compelled to leave his work and seek a blacksmith in order to have his tools, grown dull by long usage, resharpened. An invention which has been patented by Walter H. Prest, of Bedford, Nova Scotia, Canada, enables the prospector to postpone the sharpening of his tools and to save much of the time which he would otherwise lose. The invention in question consists primarily in providing the tool-stock with a removable point held in place by a key.

The accompanying illustrations show the invention applied to a pick. Fig. 1 is a perspective view of the tool; and Fig. 2 is an enlarged perspective view, showing the point, key, and stock separated.

The stock and the point are formed on opposite faces with dovetailed grooves, and terminate at adjacent ends in tongues. The inner wall of the stock-groove and the end of stock-tongue are formed with V-shaped recesses which engage the correspondingly shaped shoulders of the point-tongue and of the point-groove. When the stock and point are fitted together with the shoulders and recesses in engagement, the lateral displacement of the point is prevented. When the key is placed in position, the point will be longitudinally locked.

When it is desired to remove a dull point and substitute a new one, it is necessary merely to knock out the key. It is therefore evident that, by carrying a number of points with him, a miner can work for a long time without being compelled to take the pick to a blacksmith. The junction between the point and stock is such as to present no projection, thus enabling the pick to be used in the ordinary manner.



PREST'S IMPROVEMENT IN PICKS.

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Correspondence.

A New Star in Sagittarius.

To the Editor of the SCIENTIFIC AMERICAN:

From an examination of the Draper Memorial photographs, Mrs. Fleming has discovered a new star in the constellation Sagittarius. Its position for 1900 is R. A. = 18h. 56m. 2s., Dec. = —13° 18′. It was too faint to be photographed on eighty plates taken between October 18, 1888, and October 27, 1897, although stars as faint as the fifteenth magnitude appear on some of them. It appears on eight photographs taken while it was bright. On March 8, 1898, it was of the fifth magnitude and on April 29, 1898, of the eighth magnitude. A plate taken this morning, March 9, 1899, shows that the star is still visible and is of the tenth magnitude. Two photographs show that its spectrum resembles those of other new stars. Fourteen bright lines are shown, six of them due to hydrogen. The entire number of new stars discovered since 1885 is six, of which five have been found by Mrs. Fleming.

E. C. PICKERING.

Harvard College Observatory, Cambridge, Mass., March 9, 1899.

Removing Window Frost.

To the Editor of the SCIENTIFIC AMERICAN:

During the very cold spells of the past winter I made a number of experiments in removing ice or congelation of water from window panes, using fourteen methods. I found them efficacious in every instance, but some far superior to others. That which worked best is No. 1, that second best No. 2, and so on. I noted that in stores where there are so-called "box-windows," the congealing was most apparent; and that in some stores, where there was a comparatively dry heat, the windows were not materially affected. I place the efficacy of the remedies in the following order:

1. Flame of an alcohol lamp; 2, sulphuric acid; 3, aqua ammonia; 4, glycerine; 5, aqua regia; 6, hydrochloric acid; 7, benzine; 8, hydriodic acid; 9, boric acid; 10, alcohol; 11, nitric acid; 12, cobalt nitrate; 13, infusion nutgalls; 14, tincture solution of ferrous sulphate.

I found that by the use of an alcohol lamp (which, of course, would have to be handled with great care) the results were immediate, and the effect more nearly permanent than by any other of the experiments. The sulphuric acid application was made with a cotton cloth swab, care being taken not to allow any dripping, and so with all other acids.

The effect of the aqua ammonia was almost instantaneous, but the window was frosted again in a short time.

With the glycerine there were very good results—but slight stains on the window, which were subsequently easily removed.

I have had inquiries from store keepers, who have complained about their windows being unserviceable much of the time in very cold weather, and desiring a remedy. I thought the results of my experiments would reach widest publicity through your columns, and consequently give the facts to you.

HENRY C. DEMMING.

Harrisburg, Pa., March 7, 1899.

The Port Arthur Ship Canal.

The Port Arthur ship canal, Port Arthur, Texas, will be practically completed about March 20, when the event will be celebrated in a fitting manner. The canal is designed to extend deep water from the Sabine Pass to Port Arthur, the former having a depth of 25 feet over the bar. The dimensions are the same as those of the Suez Canal—183 feet wide and the depth is 25 feet. The canal is 7½ miles long, and the work was done with the aid of hydraulic dredges. Fourteen million yards of clay, earth, etc., were excavated. The ships' basins, slips, docks, warehouses, and grain elevator are in the course of construction. The harbor is landlocked and is an excellent one.

The Largest Ranch in the World.

The largest ranch in the world is located in Texas, and it consists of more than 3,000,000 acres, or about 5,000 square miles. The States of Rhode Island and Delaware could not contain this immense ranch. About a dozen years ago, states The Ladies' Home Journal, when Texas needed a new State capitol, the legislature adopted a novel plan to get it. A promise was held forth that a vast tract of uncultivated land would be given in exchange for a suitable granite building at Austin. Senator C. B. Farwell and John Farwell formed a syndicate in Chicago and built the capitol, and in due time they came into possession of the immense domain.

Exhibit of Patents and Inventions.

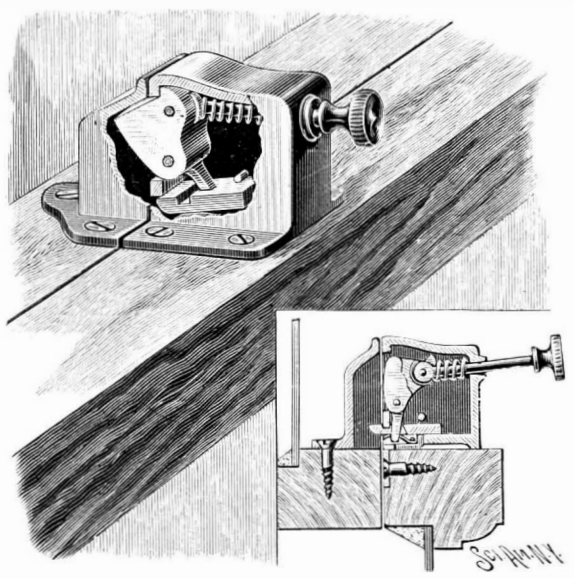
In connection with the Third Electrical Show to be held in Madison Square Garden, New York city, from May 8th to June 4th, 1899, there will be a Special Exhibition of Patents and Inventions. Inventors can bring their models before a large public and interested parties at small expense.

AN AUTOMATIC WINDOW-LOCKING DEVICE.

The window-fastening device which forms the subject of the accompanying engraving is designed automatically to lock a window in such a manner that it will be impossible to raise the sashes from the outside. The fastener is the invention of Mr. George C. Nicholson, Collins Street, Melbourne, Victoria, and has been patented in most parts of the world.

The device consists of a staple secured to one sash, and of a casing containing the locking mechanism, secured to the other sash. This mechanism includes a pivoted tumbler which is operated by a spring-pressed spindle projecting from the casing, and which is provided with a horn engaging a bolt in the lower portion of the casing. This bolt is spring-pressed into engagement with the upper lip of an aperture in the casing, which lip is adapted to fit into a notch in the bolt, as shown in the sectional view.

In unlocking a window provided with this fastening, the spindle is first pulled back until the swing of the horn has forced the notch of the bolt into engagement with the upper lip of the aperture. When the parts are in this position, the tumbler is retracted clear of the opposite sash and of the staple thereon, thus compressing the spring coiled around the spindle, as shown in the sectional view. The window may now be opened; but the raising of the sash will cause the projecting end of the bolt to be depressed by the inner, top end of the staple. The bolt, after having been sufficiently depressed, will be automatically retracted by the operation of the spindle-spring in throwing the tumbler and consequently the horn. Hence, when the window is open, the parts have the position shown in the perspective view. When the window is being closed, the descending sash strikes the projecting portion of the tumbler, forces it back, and thus causes the parts to assume their normal locking positions.



NICHOLSON'S AUTOMATIC WINDOW-LOCKING DEVICE.

The fastener is notable for its novel construction, for its automatic action, and for the means provided to prevent the window from being opened from the outside.

A Right-Handed Monkey.

BY DR. EUGENE MURRAY-AARON.

Mr. Sydney Davis, of Washington, has recently given utterance to the very plausible theory that the strong right-handed tendency of man is due to ages of warfare and strife, during which the shield-holding left hand became less muscularly active, while the development of the club-bearing or javelin-throwing right arm was correspondingly hastened. This interesting thought leads to an inquiry as to the ambidextrous condition of man's lower cousins, the monkey tribe, and especially those of the quadrumana, who, by virtue of their tree-inhabiting and fruit eating lives, have the minimum of warfare and the maximum of acrobatics to develop all four "hands" alike.

In a considerable experience with the monkeys of the American tropics, I have met with but one that could be called either right or left handed. This little creature, a "blue-faced cebus," appeared on close anatomical examination to have the same complete muscular development and quick joint action in all of his limbs. There was apparently no difference in the grasping power of the various hands, if he was compelled to use the one to be tested; nor was there, so far as the two forehands and the right "foothand" were concerned, any preference shown by him in their use. All of the three appeared to be equally useful in climbing, and it was impossible to guess which hand would be put forth to grasp a proffered dainty or a coveted article of finery.

But the left foothand was never used for that purpose unless the others were already engaged or purposely muffled, so that he had no alternative, and then only after a moment's reflection, during which he was apparently trying to devise some plan whereby its use could be avoided. Yet, when he concluded that the inevitable faced him, the grasping was as quick and the holding fully as firm, so far as I could discover, as though one of his other hands had been used. Strange to say, although so averse to using this left hindhand in the way indicated, he always seemed to prefer it as his temporary treasury, giving it the preference over his mouth, which, in most of his tribe, is the receptacle for valuables until a safe hiding place can be reached. A new brilliantly colored beetle, just brought in and emptied out from my killing-jar, and usually, I regret to say, one I could ill afford to have stolen, or a new coin or bright bit of paper having been spied, Don Juan, for so he was called, would sneak quietly up to it or make a dart at it, as seemed to him most likely to serve his purpose, grasp it in either one of the two forehands or the right hindhand, using whichever was nearest the coveted article, and, quickly transferring it, to the left hindhand, gallop off on the other three legs.

If severely scolded, Don Juan would make for a shelf over the main door to my study, from a bamboo brace to which he would hang for a long time, making remarks on the situation, which from their tone I took to vary between mild expostulation or apology on the one hand and vehement denunciation and, I fear, even simian profanity on the other, as the occasion seemed to him to warrant. While so hanging he almost invariably used two hands, rarely three, and never, in my observation, the left hindhand. His expostulations were usually accompanied with much scratching of the head and rumpling of the hair, which was banged and parted in the middle in the most foppish manner; and an occasional rubbing of the eyes with a disengaged fist added a peculiarly human touch to his dolefulness. Yet, never did I see him use that neglected left hindhand for any of these purposes. If he was in disgrace because of a theft, not yet atoned for by restitution, he usually had the stolen article folded away in that hand and held tightly against his body; if it was disengaged, however, it was never used to scratch the head, rub the eyes, or in the expostulatory gestures that all students of monkeydom are familiar with. The nervous twitching of the fingers of that hand was all that indicated its interest in current events.

Don Juan was a born woodsman, an animated compass and a barometer of more than usual storm forecasting precision. If he determined that the usual time for a naturalist's morning jaunt afield had arrived for me, he attempted to aid in my preparations therefor, getting together such articles as, in his experience as a field assistant, should be taken along. Gifted with an excellent memory of the occurrences of the day before, and apparently with a most active imagination, he decided, in some one of his brain areas, that I was going entomologizing, when, perhaps, I was bent on a fishing trip. Having set his mind on what I took with me the day before, and totally oblivious to the nature of the articles I was busy putting in the pouches of my canvas hunting coat, hanging on the back of a chair, he would busy himself, rushing back and forth from my instrument table to my coat, filling the pouches with a miscellaneous assortment of just what I did not want. These I would, at first quietly and later noisily and with much scolding, return to the table; at which Don Juan would become frantic and rush them back to the coat, with loud cries of remonstrance at my too evident ignorance of what a naturalist really needed in the fields or woods, until finally his worry and anger knew no bounds.

Under such circumstances I have seen him gather up forceps, pliers, a case-knife, a magnifying glass and like articles with wonderful rapidity; but great as was his haste to undo the effects of my ignorance, all this gathering up was done with one or more of the three favorite hands, although the articles were carried to the coat in the despised left hindhand or the mouth, from which they were invariably transferred to the pouches by one of the more active hands. This was the crucial test, in my opinion; for never was he so frantic in his haste or anxious to make every hand count in his work as when he was convinced that I was wrong in my judgment as to my collecting outfit for the day. Even when he became convinced that there was no time to lose in getting home, before a tropical storm should burst over us, when his antics and chattered warnings were accompanied by many annoyances in the shape of hair and mustache pulling, ear twitching, etc., he did not use the neglected hand.

Here, clearly, was a case where a monkey was not ambidextrous, although it appears to be the only case I can find recorded and is certainly the only one in my own observation. Mr. Crowley, Chico, Johanna and the others of the famous big members of their family, were all ambidextrous, so far as their eating and grasping habits made it possible to judge. As I said at first, Don Juan did not appear on careful examination to have suffered any injury which could account for his strong tendency to ignore the usefulness of that left hindhand; nor was I ever able, during a long and intimate acquaintance, to find any explanation for it nor to educate him out of it. It must suffice to say that he will go down in history remarkable as a right-handed monkey; although his feats in woodcraft were calculated to render him equally famous. But they will make another story by themselves.

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ANCIENT LOCOMOTIVE ENGINES.

(Continued from first page.)

with the rapidity required by an engine of the locomotive type.

The attention of the reader is invited to three early English locomotives which are illustrated herewith. The engravings were made from photographs of the engines, published by F. Moore, the well known railway photographer, of London.

Fig. 1 shows an engine built in the year 1813 by Messrs. Blackett & Hedley for hauling coal trains on the Wylam Colliery Railway, Newcastle-on-Tyne. It will be seen that the engine had vertical cylinders, grasshopper beams, and parallel motion, the cranks working toothed wheels connected to the driving axles. The exhaust steam was turned into the chimney. The boiler had a return flue, so that the fire door was at the same end as the chimney, where the fireman attended to his duties, standing in the tender. The engine driver was accommodated with a seat at the other end of the boiler, where he had the levers and working parts within easy reach.

This engine was in continuous service until the year 1862, and was afterward removed to the South Kensington Museum, London, where it has been on view ever since.

The first public steam railroad in the world was opened on September 27, 1825. It was named the Stockton & Darlington Railway and was constructed by George Stephenson. The road is about twelve miles long and now forms part of the Northeastern Railway. Fig. 2 shows the first engine to be used on this railroad. It was named "Locomotion" and was designed and built by Stephenson. As will be seen, the two cylinders were vertical and partly within the boiler; they were thus steam jacketed, which was a good idea as far as it went. The piston rods were kept in line by a species of parallel motion and were connected to cross beams, to which were attached connecting rods to crank pins on the driving wheels. The wheels were coupled, and, as each cylinder actuated but one set of wheels, the awkward looking return crank on the rear driver was necessary to keep the stroke in quarter and so avoid dead centers. The boiler had a single straight flue, which was lined with fire brick at the furnace end. In this respect it was inferior to the "Puffing Billy" (Fig. 1), which had a return flue, giving the fire time to heat the water before passing up the chimney; but in the case of "Locomotion" the fire rushed through the straight flue and out of the chimney, so that it soon got red hot when the engine was laboring. This may account for the expansion joint in the exhaust pipe, seen just back of the forward connecting rod.

The leading dimensions of "Locomotion" were: Boiler, 10 feet long by 4 feet in diameter; working pressure, 25 pounds per square inch; heating surface, 60 square feet; cylinders, 10 inches diameter by 24 inches stroke; wheels, 4 feet in diameter; weight of engine in working order, 14,560 pounds. The safety valve was pressed down by a weight. The tender was of wood mounted on wheels having a diameter of 2 feet 6 inches. A sheet iron tank of 240 gallons capacity held the feed water. The fuel was coal, and the tender in working order weighed about 5,000 pounds. The fireman stood in the tender, and the engine driver had a seat on the foot board at the side of the boiler—an uncomfortable and dangerous position.

On the opening day an immense concourse of people had assembled along the line to see the train go by, nearly every one prophesying that the engine (commonly called the "iron horse") would be a failure. At length the train was ready at the foot of the Brusselton incline, and Stephenson backed his engine down to it. It was a proud day for him, but withal a very anxious one. The train weighed about 90 English tons, and consisted of 6 wagons loaded with coal and flour, then a covered coach containing directors and proprietors, next 21 coal wagons fitted up for invited passengers (450 in number), and, lastly, 6 more wagons loaded with coal.

As six miles an hour was supposed to be the limit of speed, it was arranged that a man on horseback, acting as a marshal or herald, should ride on the track ahead of the engine, carrying a flag inscribed with the company's motto: "Periculum privatum utilitas publica."

The train was started without difficulty amid the cheers of the concourse, many trying to keep up with it by running, and some gentlemen on horseback galloped across the fields to accompany the train, the man on horseback carrying his flag with all due gravity. After a few minutes, Stephenson determined to show what his engine could do, and shouting to the horseman with the flag to get out of the way, for he was going to "let her go," and ordering the grinning fireman to "keep her hot, lad," he opened wide the regulator, and the speed was quickly raised to 12 miles an hour, and then to 15, which, it must be admitted, was a dangerous one considering the state of the track and the build of the engine.

The runners on foot, the gentlemen on horseback and the horseman with the flag were thus left far behind, and so, with the cross beams and side rods trembling with the violent motion, the red hot chimney ejecting clouds of black smoke, the roars of the delighted spectators, and the astonishment of the passengers—some of whom were "professors" of mathematics who had demonstrated that the locomotive engine could not move faster than six miles an hour—the immortal George Stephenson brought the train safely into Darlington.

The "Locomotion" was in continuous service from 1825 to 1841, when it was retired.

It is now in the Northeastern Railway Station at Darlington, and it is said to be still fit for service.

When the Stockton & Darlington Railway was in thorough working order Stephenson became engrossed in the improvement of the locomotive engine, and in the year 1829 he placed his engine "Rocket" on the Liverpool & Manchester Railway, with the success that all who take interest in railway history are familiar with. In the following year he designed and built an engine of similar construction, but of improved form. This engine was named "Invicta," and is illustrated in Fig. 3. It was placed in service on the Canterbury & Whitstable Railway, which now forms a part of the Southeastern Railway. The former road was opened May 3, 1830.

Unfortunately, the engine is in a dismantled condition, and some alterations were made to the firebox after it left Stephenson's shops, but it will be seen that the cylinders and valve chests were at the side of the smoke box, very similar to the arrangement of the modern locomotive. The main frames were of bar iron, but the cylinders were bolted to a frame of plate iron, which was firmly attached to the main frame. The wheels were coupled, but the coupling rods have become lost.

The principal dimensions of "Invicta" were: Cylinders, 10 inches diameter by 18 inches stroke; diameter of wheels, 4 feet; boiler, 10 feet long by 3 feet 4 inches in diameter; diameter of fire tube, 20 inches; working pressure, 40 pounds per square inch.

This engine is still preserved by the Southeastern Railway Company, and it is understood that by the efforts of Sir David Salomons, one of the directors, it will be (if it is not already) restored and placed on view at the Charing Cross Station, London.

An Electrical Injury.

A remarkable electric shock to an electrician occurred on the afternoon of March 7, at the power house on Lexington Avenue and 25th Street, New York. Joseph Hampel was working at one end of the switchboard when there was a flash of light and the electric lights in the building went out and the electric cars over a large section of the city were stalled. Every particle of clothing Hampel had on, except the overalls and drawers on his right leg and part of the right shoulder of his undershirt and blouse, and a piece of his right shoe and stocking, was burnt off. His body was black as burnt cork and his hair was entirely burnt off. The floor was also burned, a large hole being made into which he fell. He finally got his hand off the circuit, and, yelling with agony, ran out into the middle of the room, where a workman extinguished the flames which were still licking the man's garments. An ambulance was promptly summoned, and it was found that he was terribly burned. He was taken to the hospital, and, strange to say, it is probable he will recover. The cause of the accident is unknown. It is thought that Hampel had been using a wrench tightening a screw on the switchboard, and in some manner the screw completed the circuit.

New Comets.

Prof. Lewis Swift, who is stationed on Mount Lowe, just north of Pasadena, Cal., has announced the discovery of a new comet. It was discovered on March 3, and was a large bright comet, visible to the naked eye without a glass. The tail is flat, broad, and short. Prof. Keeler, at Lick Observatory, telegraphed to the Harvard College Observatory that Swift's comet was observed by Mr. Hussey on March 4. Captain C. H. Davis, of the United States Naval Observatory, has also telegraphed to the same observatory that the Swift comet was observed by Prof. Brown on March 5. Prof. Swift stated in his original telegram that the comet was 3 hours 45 minutes in right ascension and the declination was —29°. Prof. Swift has discovered twenty comets, and next to Sir William Herschel, holds the record for finding nebulæ.

Tuttle's Comet.—This comet was discovered by Méchain, at Paris, in 1790. Only a few observations were taken, however, and the comet was rediscovered by Horace P. Tuttle, at the Harvard College Observatory, January 4, 1858. Johannes Rahts, of Königsberg, made the most complete discussion of the orbit, combining the observations of 1858 and 1871–72, having regard also to the perturbations. His value of the period is 13·7 years. The comet was next seen in 1885, and was expected during the present year. An ephemeris was accordingly distributed from Kiel, and it was probably by means of this that a faint comet, supposed to be Tuttle's, was discovered March 5 by Dr. Wolf.

Science Notes.

The Vatican Observatory has recently issued volume v. of its "Pubblicazioni." It forms a volume of 808 pages. It is divided into four sections: astronomy, terrestrial magnetism, earthquake phenomena, and meteorology. The volume shows that they are doing excellent scientific work at the Vatican, which most people consider only in its religious and political aspect.

Mr. Louis de Rougemont still continues to publish his marvelous adventures, and each chapter becomes more wild and improbable. The editors of The Wide World Magazine began printing his wonderful stories as a contribution to geographical knowledge; but they now admit they were imposed upon, and still keep on publishing the articles for the curiosity of the thing.

Rome is to have a subway through the Quirinal Hill to the slopes of the Viminial and Esquiline. The tunnel will be 53 feet wide, with accommodation for carriages, electric cars, and foot passengers. The electric railway from the Porta del Popolo to the Porta San Giovanni will pass through it. The chief engineer estimates that it will take only seven months to build the tunnel.

Some experiments have been tried by Dr. Noel Paton, at Edinburgh. Dr. Paton has made a very thorough investigation into the life history of the salmon, the nature of the pigments which color the flesh, and the changes in its condition during migration. He concludes that when the salmon enters the river it ceases to feed, and relies on its own muscular tissue; but it is a curious fact, however, that salmon rises to the fly, which would tend to militate against this view.

It is stated that the "Physikalisch-Technische Reichsanstalt" is now using silicion carbide crystals or "carborundum," as it is called, to a great extent to replace diamonds in the production of finely graduated scales. Small, flat hexagonal crystals are chosen, from one-half to one millimeter in size. They are mounted in a steel holder by means of a drop of shellac. It is stated that the lines are much more even than those produced by a diamond. They have been examined and magnified fifty times and found to be still sharply defined.

Drs. Lange and Melzing, of Vienna, have succeeded in taking photographs of the mucous membrane of the stomach in the living subject. A stomach tube some 60 centimeters long and with a diameter of 11 millimeters is provided with an electric light at its lower end, and at the upper end is a camera. The stomach is first emptied of its contents, and after being washed is distended with air. Then fifty pictures or more can be taken in rapid succession in from ten to fifteen minutes. The apparatus can be turned on its axis so that all parts of the mucous membrane can be photographed. The photographs are naturally very minute, but they can, of course, be enlarged to any extent.

The plague microbe is most persistent. A Swiss paper gives the following facts: In 1660, the Dutch city of Haarlem was devastated by the plague. Whole families perished, and among them a family of the name of Cloux, the members of which were buried in the Haarlem church. Thirty or forty years ago it was found that the masonry of the tomb was out of repair, and the vault was entirely rebuilt. The masons in charge of the work remained in the vault an entire day, and, strange to say, notwithstanding the fact that two centuries had passed since the epidemic, all these workmen were attacked with the infectious grandular swelling called "bubo," and had to undergo treatment at the hospital. There were no symptoms, however, of the plague proper, and all recovered. It is impossible to give the reason for such a remarkable manifestation of the vitality of germs.

Telephones in England.

The Financial Secretary of the Treasury has announced in the House of Commons that the government has decided to introduce competition in the telephonic services of the country. He asked for a grant of $10,000,000 for a start, in order to enable the Post Office Department to develop the telephonic communication of London. In making the announcement Mr. Hanbury admitted that it was a notorious fact that Great Britain was far behind the United States and other countries in the matter of telephonic communication. The House adopted Mr. Hanbury's proposal.

A Great Demand for Coal.

With the great revival of trade in iron there comes a decided improvement in the anthracite coal business, which has been very much depressed, and at times the Reading Railway has been literally blocked with coal trains. There is a lack of coal-carrying cars on the railroads touching the anthracite regions. There are few dealers in the large cities who are not entirely out or at least short of coal following the February blizzard, and these are now being supplied.

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GRAPE GROWING AND WINE MAKING IN CALIFORNIA.

BY ENOS BROWN.

Prior to 1878 wine making in California was only incidental and conducted upon a contracted and unscientific basis—the product, by no means great, of many individuals, of no attainments whatever for wine making, content with quick returns. No attempt at producing first-class wines was considered. The industry at that time was conducted without combination or method.



VIEW OF VINEYARD.

The modern history of wine making dates in California from that year, when, at the instance of a number of persons engaged in the business, Mr. Arpad Haradzthy, a Hungarian and a wine merchant of great experience, was dispatched as special commissioner to Europe to report upon the possibility of manufacturing wines upon a basis admitting of a chance of rivaling the famous brands of that country and also to study the varieties of vines that were best adapted to California soil and climate. The report published after the return of the special commissioner was encouraging to the last degree, and directly the cultivation of the grape was stimulated all over the State Thousands of acres believed to be worthless and barren were set out in vineyards, and even under the early conditions, before the best methods had been introduced, grape growing was very prosperous. For a number of years grapes brought $30 per ton, which almost paid the first cost of the land and all improvements. In four or five years hundreds of new vineyards came into bearing, and grapes then began to decline, first to $25 a ton and gradually as low as $7 or $8—a price far below the cost of raising them. The natural result followed. A large number tore up the vines and went out of the business.

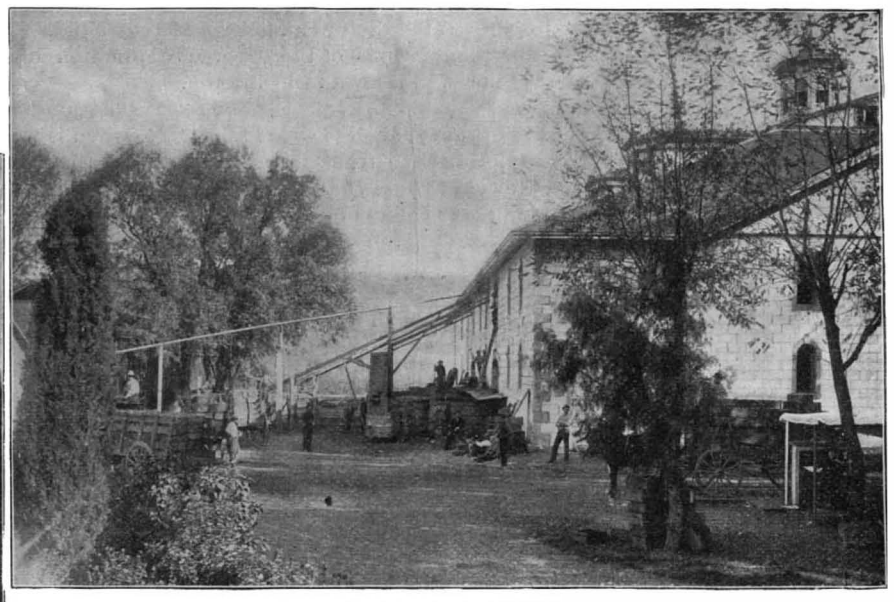
In 1893 all attempts to bring the world to an estimate of what California was capable of in wine making seemed futile. Wines a year old sold for 7 and 8 cents a gallon, and the outlook was most discouraging.

In 1898 new wines sold for 12 to 13 cents per gallon and grapes $12 to $13 a ton. At these prices there is left a fair profit to the grower and wine maker.

In 1897 the wine made in California reached the highest amount known, viz., 37,000,000 gallons. In 1898, owing to disastrous frosts early in the season, only 20,000,000 gallons were made—an amount equal only to the yearly consumption of the capital of Italy, with its 450,000 inhabitants, who each annually consum 45 gallons.

The disastrous year 1893 will be ever memorable in the history of the wine industry of California as the period marking the abandonment of the custom wineries and the rise of those great establishments which now control the far greater portion of the product of the vineyards.

Their unlimited resources permitted the employment of the highest expert talent and the holding of heavy stocks of wines until matured. Forced sales of new wines are abolished. Wines are not permitted to leave the State in inferior condition. A system of co-operation protects the reputation of brands; in fact, the entire product of the State is under control by competent and financially sufficient hands, whose interests lie in maintaining a high standard of production. The day of the subterfuge that compelled the sale of California wines under foreign labels has passed.



VIEW OF WINERY.

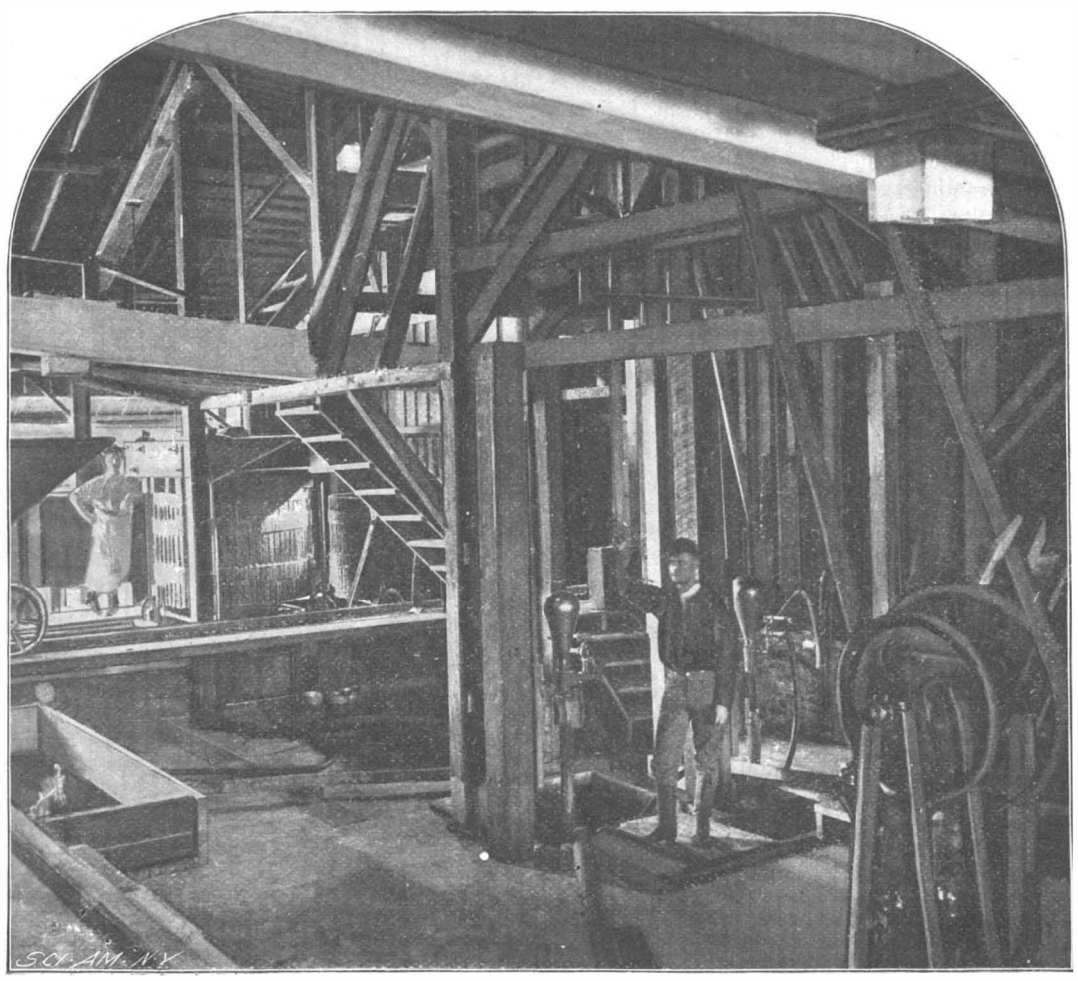


GATHERING GRAPES.

The largest winery in operation in California is that of the Italian-Swiss Colonies at Asti, Sonoma County, located about 100 miles north of San Francisco. The valley of the Russian River at Asti narrows to about three miles in width, the sides consisting of low rolling hills covered to a great depth with red ferruginous soil in which vines especially delight.

In 1881 a company of men of Italian and Swiss nationality, all from those provinces where grape growing and wine making has been the occupation of the people for centuries, projected an organization for acquiring lands suitable for growing grapes and where their practical knowledge of wine making might be employed in building up a new industry. Conditions at Asti fulfilled all their exacting requirements and 1,600 acres were purchased—lands which at that time were considered fit only for the scanty browsing of stock. No attempts at cultivation had hitherto been made upon these lands. The character of the soil determined the location. In Italy and elsewhere the vine thrives best in volcanic soil. All through the Russian River valley evidences of volcanic action in distant epochs are manifest. The remarkable phenomena of Geysers are but fifteen miles distant from Asti and near by are the great forests of petrified trees. Lava deposits exist in the neighboring hills. The soil itself is rich in evidences of volcanic influences. The climate is that of Italy. Frosts are of the rarest occurrence and the orange, lemon, fig, pomegranate, and all the fruits incidental to a climate semi-tropical flourish in native luxuriance. Irrigation is never required, the rains of winter supplying ample moisture. The grape thrives and reaches its highest perfection at Asti.

Eighteen years ago the colony purchased 1,600 acres and have since acquired 600 acres more. Grapes were planted the first year and every year thereafter new vineyards have been set, until at this time 1,000 acres are in vines, which take four to five years after being set out before bearing crops. In a few years the whole 2,200 acres will be cleared and planted. Those vines planted eighteen years ago are quite as prolific as any, and will continue to thrive for a full generation longer. There are now 1,000,000 grapevines on the lands of the colony, and the average yield is from 2½ to 3½ tons per acre on the hillsides and 4 to 5 tons in the valley. There are growing in the highest perfection the Sauvignon, Chablis, Chateau Yquem, Sauterne, Cabernet, and Burgundy, of France; the Barolo, Barbera, Chianti, and Griquolino, of Italy; besides the Riesling, Traminer, and other varieties from the Rhine; and all these delicate vines bear their transplanting well, yielding wines of the same character and flavor as on their native hillsides. The product from the vineyards of the colony in 1898 was 3,500 tons, and an equal amount was purchased from neighboring farmers, which yielded 1,000,000 gallons of wine, each ton of grapes yielding 160 gallons.



INTERIOR SHOWING WINE PRESSES.

In all California there are

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200,000 acres devoted to raising grapes, 140,000 acres for making wines, 60,000 acres in raisins. Sonoma County has 24,000 acres in grapes, which produced in 1897, the most prolific year known, 10,000,000 gallons of wine. In cultivating the grape the land is first plowed deep, and in preparation for setting out cuttings the soil must be frequently harrowed after plowing and freed of weeds. From the first these new vines, though bearing no grapes for five years, have to be cultivated with as great care as the most prolific. The cuttings are planted in rows about four feet apart, 800 to the acre. Weeds, which grow rapidly in warm climates, must be kept down. New cuttings are set out in March, during the rains of the early spring.

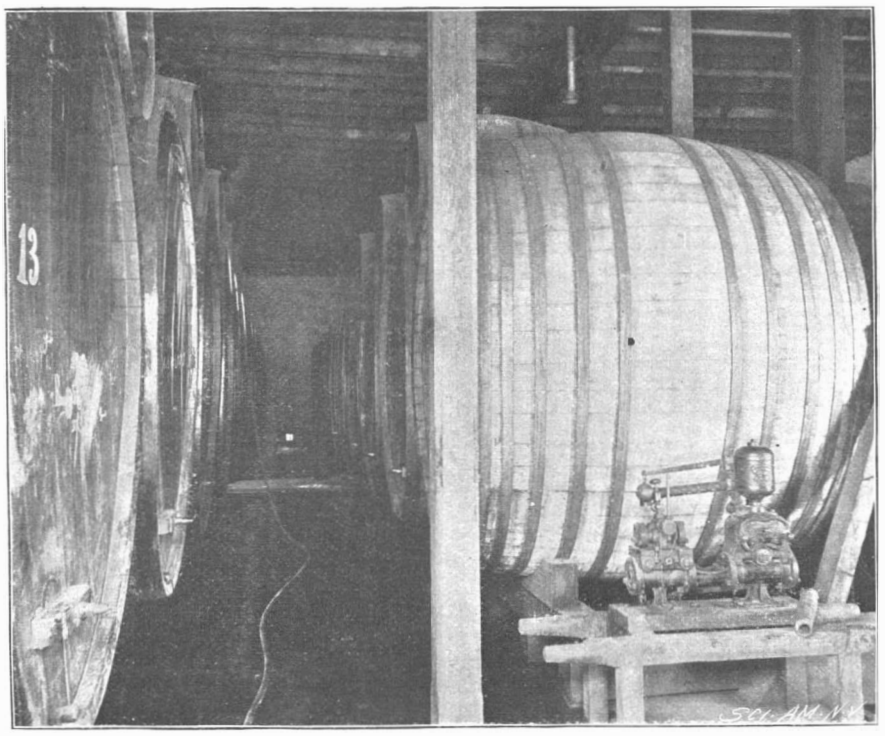
Pruning begins with the year, when the vine is dormant, and is over before the middle of February. Every vine is then cut so that all of the woody growth of the previous year is taken away down to two buds for each branch left. Gangs of men with pruning knives attack each field in turn, others following gather up the severed stalks in bunches and burn them. The plowing of the vineyard begins in the early spring, March and April, after the rains have softened the soil; plows are run across the fields in both directions. In another month the harrow follows, and this is repeated two or three times in order to pulverize the soil and exterminate weeds. After harrowing, gangs of men appear with hoes and carefully pile the soil around the roots of each plant and cut down the fast growing weeds.

In May every vine is treated to a light sulphuring applied with bellows in order to arrest mildew and destroy insects. Grapes in low vineyards require at times a resulphuring to counteract the effects of fog, which induces mildew.

In early June comes the summer pruning, which consists in topping the too rapidly growing branches and stunting the growth, with the object of economizing the labor of the vine and of throwing all its strength into the newly formed branches which are now beginning to appear. After this the vine is left to itself, without further cultivation being necessary until the grape picking season arrives.

It is in June that a vineyard in California displays its greatest beauty; the leaves are then greenest and the spreading branches interlock with neighboring vines. The whole field is covered with a moving mass of luxuriant foliage. In January, after pruning, a vineyard is most desolate in appearance, nothing is to be seen but rows of misshapen roots. At picking time the heavy bunches pull down the branches and destroy the symmetry of the vine. The leaves at this time are turning brown.

The time for grape picking is in September and October. There is no romance about the California vintage. The steady force must be augmented by a hundred men, who work from early morning until daylight disappears. They earn from $1 to $1.25 a ton for picking, and some of them can pick from one and a half to two tons a day. The vineyards are divided by lanes, along which are driven teams carrying boxes which hold about 60 pounds of grapes each and are dropped at convenient points. Each man gathers up a box and starts to pick a certain row, returning the full box to the road and taking another empty. Teams follow each other in gathering the boxes in the lanes, and, when loaded, start for the winery and await their turn at the receiver. To pick the grape crop of the Italian-Swiss Colony in one day, 1,500 men would be required.



TUNS IN THE STORAGE CELLAR.

The grapes, as they are gathered by teams in the fields, are then taken to the winery and in turn are driven to the hoppers, into which the ripe grapes are dumped. An endless rack, extending from the roadway to the cupola of the winery, receives the grapes and carries them to the stemmer and crusher at the top. Here the stems are separated from the bunches, and the skins (in the case of red wine) and juice fall into a box below and thence flow by conduit to the great tubs situated on the floor underneath. When one tub is full a gate is opened to the conduit leading to another tub, and so on. During this operation the handling of the grapes is only by mechanical means. Into these primary tubs the juice and skins remain for seven or eight days or until settled, when the wine is drawn off into another tub. The residue is then conveyed to hydraulic presses, where the remaining juice is extracted, and what is left is then taken to the brandy distillery.

The Italian-Swiss Colony winery has a yearly capacity of 3,500,000 gallons of wine and brandy, and a part of its equipment consists of 55 tubs, each having a 35,000 gallon capacity. After the wine is taken from the first tub, it remains in the next one for about four months, when it is again pumped into a successive one, where it remains the same length of time. This racking process occurs about four times a year. In each case a considerable amount of sediment results, which is commercially valuable and is known as argols and cream of tartar. In making white wines the skins of the grapes are not allowed to mix with the juice in any stage, being separated by machinery.

During the time the juice remains in the tubs, dependent upon the age and character of the wine to be produced, it is estimated that fifteen rackings are necessary; by that time all sediment is deposited and the product is ready for bottling. In the older wineries all this pumping was by hand, but in the Italian-Swiss winery all the tubs are connected by iron pipes with a steam pump which operates, fills or empties, all over the entire winery.

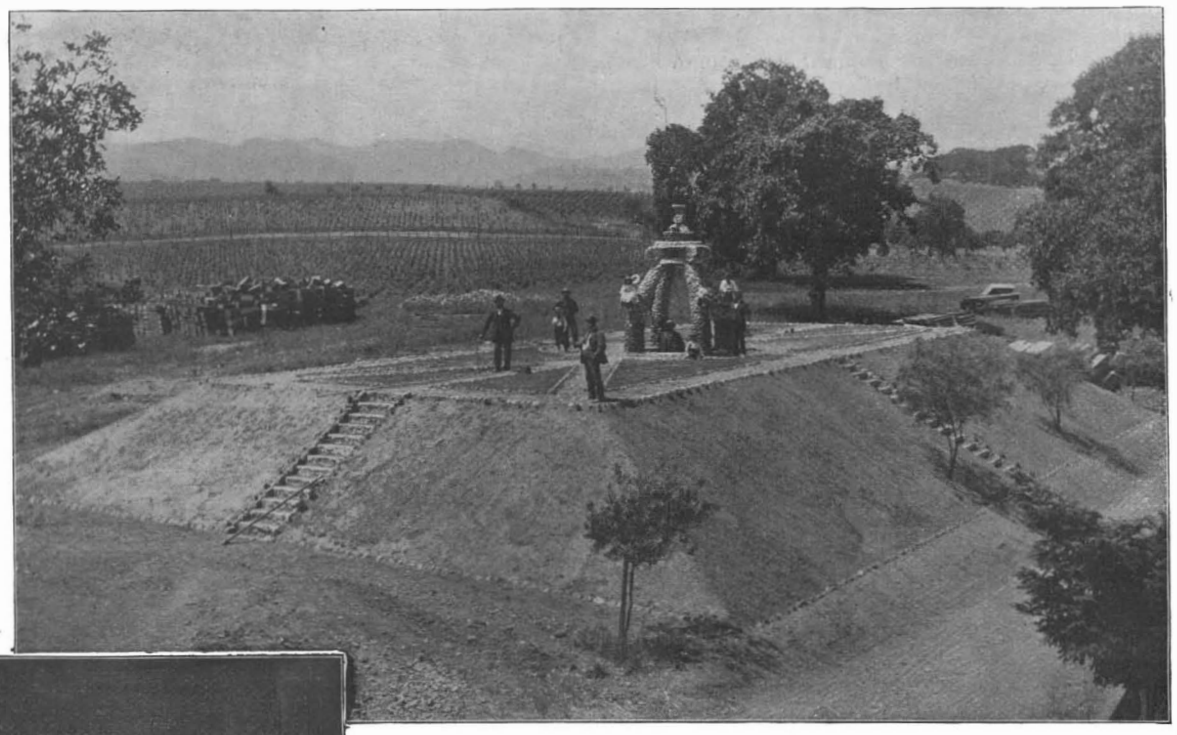
A brandy distillery is part of the equipment of this winery, having a capacity of 4,000 gallons a day.

Inferior and unripe grapes, besides all the pressed wine and the lees and even the pomace and residue of the grapes, are thus used. The product of this distillation is called "grappa," a pomace brandy. It takes from two to three years to manufacture a good article, and is a valuable adjunct to a large winery, as all by-products, which otherwise would be wasted, can be thus utilized. The residue of all this waste is returned to the soil as a valuable fertilizer. The perfect amalgamation or blending of wines is a highly scientific process, and the success and reputation of the production of a winery depends upon it. Some varieties of grapes produce a wine of too great body, strength, or flavor. The blending of all these good qualities with lighter, or with wines lacking flavor or strength, produces an approach to the accepted standard of the perfect wine.

In this winery manual labor is dispensed with as far as possible, steam and mechanical devices taking its place. Subterranean vaults excavated into the hillside afford storage for wines, and are always uniform in temperature.

The wines produced at Asti are largely what are known as dry, containing a lower percentage of alcohol than the sweet wines. In the San Joaquin Valley grapes averaging from 30 to 34 per cent of saccharine matter are grown, while in the coast counties of California, where fine, dry wines are produced, the percentage of sugar is not over 24 per cent.

The emergency of having to provide for the unexpectedly large crop of 1897 compelled the erection of



CEMENT TANK HOLDING 500,000 GALLONS.



DANCE HELD IN CEMENT WINE TANK.

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the great cement tank holding 500,000 gallons and excavated in the hillside at the Italian-Swiss winery. The tank is by far the largest for holding wine in the world, and is 80 feet long, 34 feet wide, and 24 feet high, with sides 2 feet thick. The inside walls are glazed. Wine is drawn from it through pipes, flowing by gravity.

The correspondent of the SCIENTIFIC AMERICAN is indebted to Mr. P. C. Rossi, president of the Italian-Swiss Colony, for much valuable information.

GEORGE W. MELVILLE, CHIEF OF THE BUREAU OF STEAM ENGINEERING.

The events of last year have brought into great prominence the work of the various bureaus of the Navy Department. For years the little band of chiefs labored away, and perhaps there was too little known of the men who were building the American navy. Suddenly an emergency arose, and it was found that the competent and conscientious men in charge of the various bureaus had discharged their duties so admirably that when the men who fight ships came to use them, everything was found ready. The importance of the work of these bureaus has long been recognized by those familiar with the subject. We have already given a biographical sketch of Philip Hichborn, Chief Naval Constructor of the United States Navy. Now, proceeding in logical order, we come to the Bureau of Steam Engineering, over which Captain George Wallace Melville has presided since August 9, 1887, as Engineer-in-Chief, U. S. N.

Admiral Melville was born in New York city, January 10, 1841, of Scotch parentage, one of his ancestors being Sir James Melville, who was First Lord of the Admiralty at the time of the expedition of Parry to Baffin's Bay, and whose name has been perpetuated in Arctic lands and waters. Young Melville was educated in the public schools of New York city and then at the Brooklyn Polytechnic. He then entered the engineering works of James Binns, of East Brooklyn, and here he laid the solid foundation on which his future work was based. In 1861 he became an officer of the Engineer Corps of the United States navy. He served in a number of engagements, and when in Bahia Harbor it was decided to ram the Confederate cruiser "Florida," it was mooted that the boilers would be wrenched loose, breaking steam pipes and scalding all below. It is at such a time as this that the true qualities of a man like Melville are shown.

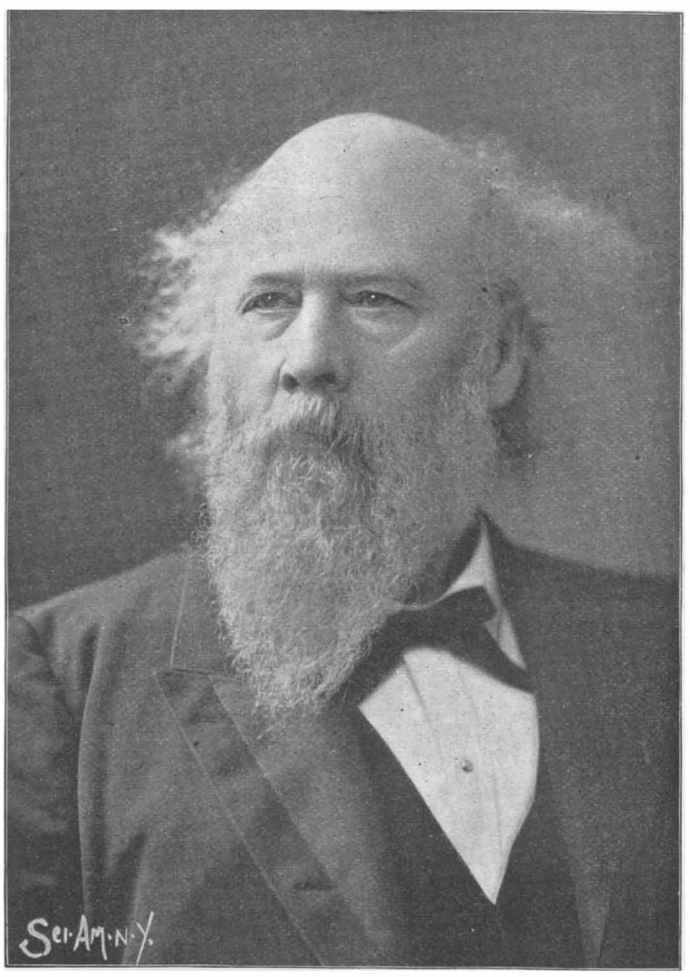
He said, "I do not think the boilers will break loose; but if they do, there need be but one man sacrificed, for after the engines are started I can work them alone and will order all hands on deck." A couple of days later the attempt was made, and Melville and one fireman who refused to leave him struck the "Florida" on the starboard side, cutting her down a foot and a half below the water line. The after broadside gun was hurled down the cabin hatch, and the ship's company was buried beneath the awnings. With the aid of a discharge from the broadside guns, the boarding party of the "Wachusett" was enabled to seize the Confederate vessel. Melville himself was one of the few injured ones. He received an ax stroke across the back of the left hand. The injured vessel was made fast by hawsers and was taken to Hampton Roads, where an "unforeseen accident" caused the "Florida" to sink, thus letting the United States government out of a predicament, for, of course, the capture of the "Florida" was an inexcusable violation of the rights of neutrality. The American people were delighted with the result, and it may be said in passing that neutral countries had very slight regard for their neutrality during this period.

After the civil war Melville served on various vessels and made trips to the Arctic regions in the "Jeannette" and "Thetis." In 1873 Melville volunteered as engineering officer on the "Tigress," and, notwithstanding the miserable condition of the engines and boilers, he succeeded in finding the camp of the "Polaris." Six years later we find Melville again leaving for the icy North in the "Jeannette" with De Long. The expedition was almost unparalleled for its suffering. They left San Francisco on July 8, 1879, and ice was met early in September a short distance northwest of Behring's Straits. The vessel was soon pinched in the ice-floe and after drifting for two years she was crushed and sunk, leaving the crew shelterless in midocean. The expedition was embarked in three boats. Melville's boat reached land and the crew completed a retreat of over 2,200 miles in 100 days. At last they succeeded, after unparalleled exertions, in reaching a Russian village. The daring and endurance exhibited by Melville in his search for De Long and his men forms one of the most noble examples of devotion and self-sacrifice which has ever occurred in the Arctic regions, the home of brave deeds. Finally, on March 23, 1882, he found his dead shipmates. In 1884 we again find him going northward with a squadron dispatched to the relief of the "Lady Franklin Bay Expedition," and he was among the first to reach the dying men at Cape Sabine, and this closes the glorious part of his career as an Arctic explorer.

While Chief Engineer of the United States Bureau of Steam Engineering, vessels have been constructed whose aggregate machinery amounts to over 350,000 horse power, and varies from torpedo boats to battleships. The term of office of chief engineer is four years, and he is now serving his third term. By the Navy Personnel Law he is now a Rear-Admiral.

The technical press of the country has always upheld Chief Engineer Melville in his efforts to obtain high speed for warships. He is a strenuous advocate of large boiler power and ample bearing surface, and that he is right in his position is shown by the splendid work which was accomplished by the "Oregon" when the squadron of Admiral Cervera was destroyed.

Chief Engineer Melville is resourceful, and adds to engineering training and vast experience the inventive genius of the American. He has been particularly anxious to secure a higher degree of recognition for the engineers of the navy, and his annual reports are read with interest and widely quoted and favorably commented upon. In the course of his lifetime Chief Engineer Melville has been the recipient of many honors, both at home and abroad, but we doubt if any was more pleasing than his election as president of the American Society of Mechanical Engineers, at its recent meeting in New York city.



REAR-ADMIRAL GEORGE W. MELVILLE, CHIEF OF THE BUREAU OF STEAM ENGINEERING.

Rear-Admiral Melville is about six feet in height, and has the stalwart frame which suggests his Caledonian ancestors. His massive head shows us the man of genius and of character. He is a man of whom all Americans should be proud.

Paris Exposition of 1900.

BY A. H. MATTOX.

Major Fred Brackett, secretary of the United States Commission to the Paris Exposition of 1900, who has charge of the New York offices of the Commission, reports that rapid advancement is being made on the buildings and grounds of the Exposition in Paris.

The vast carcasses of iron and steel and masses of stone that a few weeks ago had a meaning alone for architects, builders, and engineers are beginning to take form and shape and appeal to the public eye with their symmetry and beauty.

The roofs of both palaces of fine arts are about completed, and for the next few months the decorators, sculptors, and artists will have full swing in the work of painting and the embellishing of the interiors of these buildings. There should really be no doubt as to the Exposition being in readiness by April, 1900.

Work on the Trocadero grounds is progressing rapidly; the greater part of the masonry for the various palaces to be erected on the Place des Invalides has been completed, and work on the Alexander Bridge across the Seine, which is to connect the Champs Elysées with the Place des Invalides, is advancing rapidly under the supervision of its engineers.

The funds invested so far in the Paris Exposition amount to six million six hundred thousand dollars. Of this sum about five million dollars was expended in 1898. The city of Paris has already contributed two million four hundred thousand dollars of the four million dollars promised, and a half million dollars has been contributed by the Western of France Railway.

The space to be occupied by the Exposition is about three hundred and sixty acres. Of this amount the French government has allotted about sixty per cent for all other nations, reserving about forty per cent for themselves. The space thus far secured by Commissioner-General Peck for the United States is about two hundred and twenty-two thousand square feet.

The main entrance to the Exposition will be located at the extreme northeast corner of the grounds, at the place where the Quai de la Conference adjoins the Place de la Concorde. The main entrance to the Exposition is now being rapidly constructed. It takes the form of a triumphal arch, surmounted with a frontal bearing the arms of the city of Paris, which serves as a pedestal for a colossal statue of Liberty. M. R. Binet is responsible for this triumphal entrance, which will be a masterpiece of decorative architecture. The two friezes on either side of the arch represent workmen carrying the produce of their labor to the Exposition, and are designed by M. Guillot. By an ingenious device the ticket office to this main entrance will be arranged to admit sixty thousand persons per hour. The cost of this magnificent monument will be about three hundred thousand dollars.

On the quai which extends along the north bank of the Seine lies the Champs Elysées, in a part of which was held the Exposition of 1855. The Palais de l'Industrie, which was the principal building of that Exposition, has been demolished to make room for the two art palaces which are to be known as the Great and Little Palaces of Fine Arts. They will cost about four and a half million dollars, and will remain as permanent embellishments to the city of Paris. These new palaces of fine arts will be two of the most modern and useful buildings of their kind in existence. The Grand Palace will be utilized during the Exposition as the Palace of Fine Arts. In the way of painting, sculpture, architecture, and drawing it will probably surpass anything the world has ever seen. The masterpieces of fine arts of the century will have a place in this palace. In the smaller building will be displayed the retrospective exhibition of art. Work is now being pushed on these palaces night and day.

Across the Seine, joined by the new Alexander III. Bridge, lies the Esplanade des Invalides. This tract extends from the Seine to the Hotel des Invalides, and here will be located the great building of General Manufactures. This building will be the largest at the Exposition and in architectural design most elaborate.

Near the Manufactures Building will be the Education Building and numerous minor structures. On the south bank of the Seine is the Quai d'Orsay, on which will be the pavilions of all foreign nations, also the Army and Navy Building. On the north bank of the Seine will be located the building of Horticulture, also of Agriculture. In the Trocadero grounds will be located the Colonial exhibits both of France and other nations. The building devoted to electrical industries will probably play the most important part of any at the Paris Exposition. It will be located across the river Seine from the Trocadero Park. In this building there will be a huge central generating plant, with thousands of motors distributed all over the Exposition in every department.

The building, a capacious one, is designed for both ornament and usefulness. It is square shaped, with a cupola at each corner, and the main part is a mass of delicate ornamentation. At night, when ablaze with electric light, it will be the center of attraction and will present a scene of great beauty. In the central courtyard of the building will be an electrical fountain with a series of cascades all brilliantly illuminated by varicolored lights. On the exterior of the palace will be innumerable electric lights of various shades, colors, and devices. Crowning all, on the topmost pinnacle of the building will be a mass of flashing electrical flame forming a statuesque group, designed by a famous European artist.

The Palace of Electricity will be devoted to the exhibit of electrical machinery and the thousand and one inventions to which electricity has been utilized. The demand for space from the United States for the department of electricity far exceeds that which Commissioner-General Peck will be able to give.

To the west of the court on which will stand the Palace of Electricity will be located the buildings devoted to chemical industries, transportation, and civil engineering, liberal arts and instruments, letters, arts, and forestry.

On the east side of this same court will be the Machinery Building, the buildings of Mines and Mining, of Navigation, and the Textile Building. American

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electricians will be much in evidence at the Exposition, and it is estimated that the manufacturers of American electrical machinery will expend over one million dollars in their exhibit in 1900. American artists, too, will be well represented, and the products of the earth—agricultural, horticultural, forestry, fisheries, food stuffs, textile fabrics, placer mining, and metallurgy—will all receive complete attention from American exhibitors. The United States will also have an immense department of hygiene and one of public and organized charities.

The need of space is so great that two and a half acres of ground have been made by the French commissioners by filling along the banks of the Seine. The gardens and terraces on both sides of the river will be utilized and exhibits will be made on each side of the river Seine.

As the Exposition will occupy so much space on the Seine, it will be necessary to build several foot bridges across the river. One foot bridge will be situated near the Pont des Invalides, which will be built entirely of iron, decorated with electric lamps disposed in groups, forming luminous flowers. The pillars supporting the bridge will also be brightly lit up, adding a fine effect to the Fair at night.

Another foot bridge will cross the Seine near the Pont de l'Alma. It will be constructed of barges supported by pilasters decorated with maritime symbols. The entire bridge will be covered with a large awning. Still another foot bridge—a suspension bridge—will cross the river in front of the Palais des Armées de Terre et de Mer.

The municipality of Paris will do all in its power to make the city more beautiful than ever in 1900. The Municipal Council has already sanctioned the outlay of large sums of money for the rearrangement of many public gardens and squares and for the brushing up and cleaning of numerous monuments. The Bois de Boulogne, one of the finest promenades in the world, will be improved at great expense.

It is more than likely that horse traction will disappear in Paris during the Exposition year, in the way of omnibuses, tramways, cabs, and carriages—electric motors taking the place of the horse. It is estimated that more than ten thousand horseless vehicles will be in use in Paris in 1900.

The United States will have the largest and most important display at the Paris Exposition of any foreign nation. The Hon. Ferdinand W. Peck, U. S. Commissioner-General, in an interview says:

"The United States exhibit is not to be made for the French people. The eyes of the whole world will be upon us on that occasion in the great metropolis of France. There will then be assembled in Paris the exhibits of fifty-seven nations and the representatives of five hundred million consumers. Millions of people coming from all parts of the world will visit the Exposition. It will be the great opportunity in our history to present our resources and products to all these people with a view to increasing our export trade. In my judgment every hundred thousand dollars expended in the creation of our display will bring millions in return to our producers and manufacturers.

"Our national pride, as well as our material interests, demand that the United States, the greatest of all, should be a prominent participant among other nations at that International Exposition.

"Our national pride also demands that the great United States of America, recently splendid in war, should stand alongside of her sister nations grandly displaying her arts of peace, and the world expects this of us."

The Exposition is to open April 15, 1900.

Probable Opening of the Chicago Drainage Channel.

The Drainage Board officials are trying to have the channel opened by October 9. The contractors have been instructed to increase their forces in every unfinished section and to push work night and day. The entire channel is practically finished with the exception of the two sections at Joliet, where the Desplaines River empties into the canal. 1,800 men are at work night and day in two sections.

THE NEW AMERICA CUP DEFENDER.

When it was announced last year that another challenge for the "America" cup had been made and accepted, the hearts of all yachtsmen were greatly rejoiced, for there is no event in the annals of yachting that approaches these international contests in respect of the amount of care, skill, expense, and enthusiasm with which they are arranged and carried out.

When the two rival cutters cross the line for the first race, on October 3 next, four years will have elapsed since "Defender" and "Valkyrie III." contested for the historic cup. It was feared that the unfortunate squabbles that characterized the last attempt of Lord Dunraven to secure the trophy had killed the sport for at least a decade to come, and it was therefore in the nature of a pleasant surprise when Sir Thomas Lipton opened negotiations for another series of races.

The "Shamrock," as the new challenger is to be called, will, like the "Valkyrie," be owned by an Irishman; for Sir Thomas, although he has long been resident in England, is Irish by birth. It was originally intended that the "Shamrock" should be Irish not merely in name and ownership, but in design, materials, and workmanship, and, accordingly, the construction was to have been intrusted to the famous yard of Harland & Wolff, at Belfast. For some reason or other, a change of plans occurred, which resulted in the yacht being built by the torpedo boat builders Yarrow & Company, of Poplar, London. The plans, moreover, have been drawn up by Fife, the noted Scotch designer, whom many Englishmen believe to be superior to Watson, the designer of "Thistle," "Britannia," and the "Valkyries." So that the "Shamrock" will be truly British, with an Irish name, Scotch in design, and English in materials and construction.

Very little has leaked out as yet regarding the new vessel, but it is known that she will be built fully up to the limit of length (90 feet on the water line), and that she will be largely constructed of nickel steel.

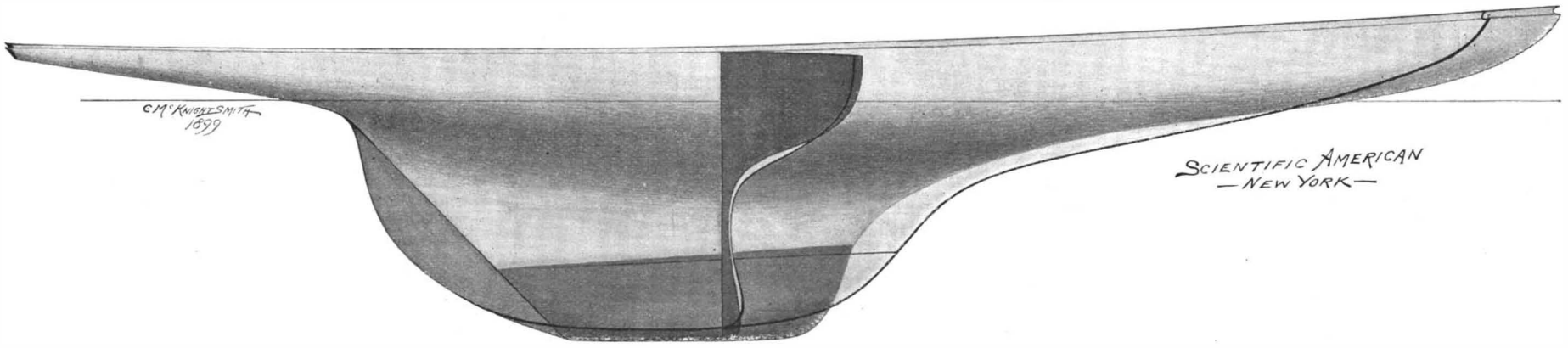
The new "Defender" is being built from plans of the Herreshoffs in their yard at Bristol, R. I. This famous firm has been identified with yacht construction from the very first, and in the year 1893 they became prominently identified with international yacht racing by designing and building three famous single-stickers—the "Navahoe," which crossed to England in quest of the Brenton's Reef cup, which was carried home by "Genesta" in 1885, and the "Vigilant" and "Colonia," the former of which was the successful cup defender in 1893. In 1895 the Herreshoffs designed and built the "Defender," and it was inevitable that in the present instance the genius of the Bristol yard should again be invoked to guard the coveted trophy.

The new "Defender" will be built upon the general lines of the 1895 boat, with such improvements in the way of model, materials, and sail plan as were suggested by her performance in the trial and the cup races. The changes in dimensions, etc., are shown in the table herewith given, and the form of the two boats is shown in the accompanying drawings. It will be seen that the beam and draught have both been increased by one foot, while the water line length is greater by about a foot and a half. Looking at the midship section, it will be seen that the new boat, in addition to greater draught and beam, has a fuller bilge, the area of the section being greater by about a dozen square feet. The lead keel, while not so long by several feet, is deeper, and there is more of it; in shape it is less bulbous than "Defender's" and approximates more nearly that of the "Valkyrie III."

THE OLD AND NEW CUP DEFENDERS.

	"Defender."	"Valkyrie III."	New "Defender."
Length over all	126 feet.	130 feet.	131 feet 4 inches.
Water line length	88 feet 5⅜ inches.	88 feet 10⅜ inches.	89 feet 10 inches.
Beam	23 feet 3 inches.	26 feet 2 inches.	24 feet 2⅛ inches.
Draught	19 feet.	20 feet.	20 feet.
Displacement	143 tons.	158 tons.	149½ tons.
Sail area	12,640 square feet.	13,026 square feet.	13,940 square feet.

Altogether it is evident that Mr. Herreshoff has aimed to produce a more powerful boat without making any great increase in displacement, the new boat carrying nearly 14,000 square feet of canvas, against 12,640 square feet for the "Defender," although her displacement is only 6½ tons more. The "Defender's" strongest point was reaching, her weakest, running with the wind dead aft. In windward work she was not quite up to expectations, and it is a question whether in this respect "Valkyrie III." was not superior. Running with spinnaker set, she was inferior to "Vigilant." In reaching she was unapproachable, and if in the new "Defender" Herreshoff has succeeded in retaining the magnificent reaching qualities of the 1895 champion, at the same time bringing up her windward and leeward work to the same level, there is very little probability of the cup being carried to England at least for another year.



THE NEW CUP DEFENDER.

Heavy line shows old Defender; shaded hull and section show new Defender.

A Victim of Automatic Gas Meters.

The automatic gas meter or prepayment meter, as it is termed, has claimed its first victim. A grocery clerk in Brooklyn went out leaving his gas burning, and the one jet exhausted the small remaining quantity of gas which had been paid for and the meter cut off the flow of gas. The man returned and went to sleep. Another member of the household dropped another quarter of a dollar in the meter, and the gas poured into the man's room, asphyxiating him. He had been dead over an hour when the accident was discovered.

An Electrical Cooking School.

At the Oread Institute, Worcester, Mass., there is an electrical cooking school. The current for the purpose of heating and lighting is furnished by the 37½ kilowatt Westinghouse direct 110-volt dynamo, driven by a belt from a Westinghouse engine.

The practice kitchen where instruction is given is a circular apartment 35 feet in diameter. In the center there is a fountain and around this is a circular slate-topped bench upon which the students can work at gas or electrical stoves. Each pupil has an independent stove, and the teacher can walk around in the space between the fountain and the bench and inspect the work of each pupil. There are twenty-four plug sockets connecting with the stoves and heaters by flexible cords. In another part of the room, against the wall, is a slate-topped table on which various special heating devices are arranged. There is also an electrical oven, a chafing dish, and other culinary appliances. Two adjoining demonstration classrooms and a special laboratory are also provided. The cooking appliances were furnished by the American Electric Heating Corporation.

The Current Supplement.

The current SUPPLEMENT, No. 1211, is a very attractive number. The first article is the new Japanese cruiser "Chitose," built by the Union Iron Works, of San Francisco, Cal. It is fully illustrated with views showing the construction and the completed vessel. "Submarine Surveying" is an article by Charles Bright. "Concerning the Theory of Evolution" is a lecture by Charles Shaw. "Paris Metropolitan Railroad" describes the new rapid transit system of Paris. The second installment of "Trade Suggestions from United States Consuls" is published in this issue and consists of eleven interesting announcements of opportunities for American trade. "Cast Iron" is an important paper by Dr. Moldenke.

Contents.

(Illustrated articles are marked with an asterisk.)

America's cup defender ... 171
Books, new ... 172
Canal commission, selection of the new ... 162
Canal, Port Arthur ship ... 166
Cars, to prevent crowding in ... 162
Chiefs, naval bureau ... 163
Clock dial, electric ... 165
Coal, great demand for ... 167
Comets, new ... 167
Dashiell, death of Lieutenant ... 163
Exhibition patents and inventions ... 166
Farmer and the patent system ... 162
Frost, removing window ... 166
Grape growing and wine making in California* ... 168
Gun, 13-inch* ... 164
Heater, water* ... 165
Injury, electrical ... 167
Inventions, index of ... 173
Inventions recently patented ... 171
Kruesi, death of John ... 163
Locomotive engines, ancient,* 161, 167
Matting, alarm* ... 165
Melville, George W. ... 170
Mirror, Japanese magic* ... 164
Monkey, right handed ... 166
Oceanic and the steel trade ... 167
Paris Exposition of 1900 ... 170
Patent system and the farmer ... 162
Perforator ... 165
Picks, improvement in* ... 165
Railways, England to study American ... 165
Science notes ... 167
Sportsmen's Exhibition ... 163
Star in Sagittarius ... 166
Supplement, current ... 171
Telephones in England ... 167
War history, photographic ... 165
Water heater* ... 165
Window locking device* ... 163

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RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

POTENTIAL REGULATOR FOR DYNAMO-ELECTRIC MACHINES.—ALLEN A. TIRRILL, Whitefield, N. H. In a prior patent granted to the same inventor, an automatic potential-regulator for dynamo electric machines was described, which regulator was designed automatically to adjust the voltage on the supply wires. The present invention is an improvement upon that device and is designed to overcome certain objections developed therein, chief among which was the sticking of the solenoid contact-points. The new invention obviates the difficulty by providing a relay, a second set of contact-points, and a separator or supplemental circuit. The improved device is designed to insure the maintenance of a uniform potential, notwithstanding the varying tax on the feed-wires.

Mechanical Devices.

MECHANICAL MOVEMENT.—LOUIS M. GAUTIER, St. Malo, France. This invention provides a motor-car so geared as to transform reciprocating rectilinear motion into continuous rotary motion. The mechanism employed is essentially characterized by the use of grooves or cams of curvilinear, polygonal profile, rotated by sets of rollers (operated by connecting rods) turning within their perimeter, and by the use of friction-wheels transmitting the rotatory motion between two clutch-cups. The variation in the relation of transmission is obtained by changing the degree of inclination of the friction-wheels toward the axes of the system.

STAPLE-FORMING AND DRIVING APPARATUS.—BONIFACE A. GRASSBERGER, Sta. A, Richmond, and BENEDICT J. GRASSBERGER, Buckner, Va. The machine provided by these inventors is designed to form, drive, and clinch staples of wire, and is particularly adapted for use in connection with wood-veneer butter-dishes. In the machine a pivotally mounted clinching arm is provided, which is actuated by a cam-lever. The lever is connected with a vertical reciprocating rod. This rod moves the staple-forming tool. A staple-driving tool has connection with the staple-forming tool. An anvil is mounted in the lower portion of the tool-passage-way, and has a staple-forming tool operating therewith. A staple ejecting plate is mounted to move past the anvil.

PERFORATING-MACHINE. — JAMES J. FLETT, Corvallis, Ore. The machine is provided with a movable slide in which a number of drills are journaled having crank-arms, connected by a rod. The slide carries means by which motion is imparted to the crank-arms to rotate the drills in unison. A spring-pressed presser-foot is movable on the slide, and has bearings for the lower ends of the drills to permit a ready withdrawal of the drills without causing the material to move up through the drills. The machine can readily perforate a large number of sheets of material, so that the holes will be in perfect register.

BOLTING-CLOTH-CLEANING BRUSH.—HARM H. EMMINGA, Golden, Ill. The frame of this brush is formed in sections adjustably secured together, and is mounted on the bolting reel-shaft and adapted to maintain a vertical position while the reel is rotating. A brush is carried in the upper section of the frame, the shaft of which brush carries a pulley. On the reel-shaft another pulley is carried. A belt connects the two pulleys to drive the brush. The brush is so constructed that it may be easily mounted on the reel shaft or detached therefrom without first removing the spiders from the shaft.

ASPHALT APPARATUS.—FRANK BURGER, Brooklyn, New York city. This invention provides an apparatus for compounding asphalt for use on pavements. The apparatus embodies a wheeled frame on which are mounted a sand-heating and drying furnace, boiling and mixing tanks for pitch-asphalt, and measuring and amalgamating devices by which to amalgamate the sand and pitch-asphalt. All parts of the apparatus are connected to work in unison by gearing driven from an engine on the framing.

Railway Appliances.

TRIPLE VALVE.—JOHN V. WELLS, Wilmerding, Penn. The purpose of the invention is to provide improvements in triple valves, whereby the auxiliary reservoir is cut off from the train-pipe on an increase or excess of pressure. According to the invention, the main piston and slide-valve are held in lap position at whatever pressure there may be in the auxiliary reservoir and brake-cylinder, whereby more uniform braking throughout the several cars of the train is obtained.

TURNTABLE-OPERATING MECHANISM. — GABRIEL ROHRBACH, Del Rio, Tex. The present invention is an improvement upon a similar invention patented by the same inventor. The improvements comprise a novel mechanism for giving motion to the operating device, and also an ingenious construction of the links connecting the dogs with the operating mechanism, by which the dogs are given a better support.

TURNTABLE-LOCK.—GABRIEL ROHRBACH, Del Rio, Tex. This lock comprises bars lying alongside each rail and mounted to slide so as to be projected into contact with the fixed rails, two operating-levers and connections therefrom to the corresponding lock-bar, and a latch pivoted between the extreme positions of the levers and having projections adapted to engage the levers in either position. The lock holds the table in position so that its rail ends correspond with the rail ends of the fixed track.

VENTILATOR FOR CARS.—LORIN W. CANADY, Goyah, Texas. This invention provides an apparatus for ventilating cars and other chambers by means of thermostatic regulators through the medium of movement-transmitting mechanism controlled by a thermostat, and of peculiarly-constructed shutters or covers by which orifices are opened and closed in accordance with the conditions of the temperature.

Miscellaneous Inventions.

DEVICE FOR CRIMPING ARTIFICIAL FLOWERS. — JULES DE GRANDMONT, Brooklyn, New York city. The device comprises two disks or frames, each having upon adjacent faces radially disposed, alternating rows of petal-engaging points, and means for centering the two disks and for giving them relative angular movement. The pressure of a blank between the two disks and the circular movement given to the upper disk, results in crimping the petals in such a manner that they have a more life-like appearance than could otherwise be obtained.

BERRY-CRATE. — GEORGE I. FEIT, Phillipsburg, N. J. This berry-crate has a cover provided with a non-conducting inner lining, cross-bars engaging the upper edges of the crate and forming ventilating-openings above the berries, and a wire secured to the ends of the cross-bars and extending along the sides of the cover to prevent the escape of the berries. The ventilation, in a crate thus constructed, is considerably improved; and the berries are protected against scalding when exposed to the sun during transportation to market.

SCISSOR AND TOOL SHARPENER.—CHARLES A. DOW, Sioux City, Iowa. The sharpener is designed to be attached to a sewing-machine. The device is provided with a grinding-wheel, a carriage mounted to travel lengthwise of the wheel, and a guide for the implement, which guide may be adjusted to preserve the proper bevel of the cutting edge of the implement, or to hold the implement at any desired angle to the periphery of the wheel.

HORSESHOE-PAD. — DANIEL CRUISE, Manhattan, New York city. This horseshoe-pad is constructed of rubber or other resilient material, and is provided with grooves, wherein are embedded strips of leather or other hard material, so that the pad retains all the advantages of elasticity and at the same time presents indurated surfaces to the ground in order to prevent the slipping of the horse's feet.

SHOOTING-GALLERY.—JOSEPH M. BAIER, Dayton, Kan. The present invention seeks to provide a novel target for use in shooting-galleries. The target in question is constructed in two parts hinged together. A stop is mounted upon the target-base and limits the downward drop of the movable part of the target. An elevating incline engages the upper part of the target to raise it after having dropped.

HARNESS-RING. — JAMES W. FISHER, Palouse, Wash. An improved construction of biting and breeching-ring is furnished by this invention, the construction of the rings being such as to simplify the harness, and to prevent the harness from unduly chafing the animal. An angular bar is attached to the ring at its inner face, and projects within the interior space of the ring. An intermediate bar is secured to the body of the ring and the angular bar; and a loop is formed upon the intermediate bar and adapted to receive a hook. The ring receives the inner end of the holdback-strap, and the loop the connections with the breeching.

MAGAZINE-FIREARM.—WALTER W. WOOD, Washington, D. C. This firearm presents many novel features of construction, which differentiate it from others of the same class. The arm is hammerless, and has no projections upon the frame. The frame is entirely closed and solid at the upper surface, thus preventing the entrance of rain, snow, or dirt. The arm is of such construction that the spent shell is ejected downwardly, and dropped near the feet of the marksman, instead of being hurled into the air in front of him. The weapon possesses the merit of embodying fewer parts in its lock and repeating mechanism than most guns, and of including in its construction a simple action.

COCK AND VALVE FOR BOTTLES. — JULES BENGUÉ, Paris, France. The present invention seeks to improve the construction of receptacles which are adapted to contain and spray liquids. The improvements in question pertain chiefly to the conical discharge-valve, which controls the amount of liquid sprayed. The valve ordinarily used, though very effective, is open to the objection of being liable to leak. To obviate this defect, the inventor has materially changed the construction by movably attaching the conical point or valve on the stem which regulates the position of the valve relatively to its seat. Owing to this movable arrangement, the conical valve will automatically assume a position concentric and coaxial with the seat, thus insuring uniform friction and even wear, and hence a tight joint.

FLY-PAPER HOLDER. — ROBERT D. SAFFORD, Brooklyn, New York city. It is the purpose of this invention to provide a device for holding a sheet of sticky fly-paper, so that the paper will be extended, will not roll, and will not come into contact with other objects. The holder is made of bent wire, and comprises a frame upon which the paper is laid, and two bails pivoted to the edges of the frame and folding over the paper. By this construction a guard is formed for the sticky surface of the paper. The device has the merits of simplicity and cheapness of construction and of efficiency of operation.

FOLDING-UMBRELLA.—CARL A. ROSENHOLZ and JOHN H. LAMPE, Wardner, Idaho. The stick and ribs of the umbrella are telescopic, and are so constructed that the umbrella may be readily reduced to less than half the length of the ordinary umbrella. The runner, ribs, and stretchers may be removed, and corresponding parts of less dimensions substituted, thus enabling the stick to be used for a parasol cover and frame. Both the handle and ferrule can be detached so as to lessen the length of the stick. The cover can also be readily taken off and replaced, to enable covers of different colors to be used on the same frame.

BINDER-FRAME.—HARVEY P. JONES, Chicago, Ill. This invention has for its purpose the provision of a binder-frame which shall be readily adjustable to permit a convenient and quick binding of the leaves in such a manner that they may be separately moved and interchanged. The frame has a back with top and bottom flanges, and guideways posited transversely to the back. L-shaped cover-plates are fitted to slide on the guideways, and have end flanges fitted closely to the back flanges to form at all times a casing with the back whether the cover-plates be moved inward or outward. The cover-plates can be moved simultaneously toward or from each other in order to close or open the binder-frame.

EXERCISER. — ABRAM A. HENDRICKSON, Hollis, Queens, New York city. Connected with an elastic cord adapted to receive handles at its ends and provided with an eye midway between its ends for attachment to a support, are a non-elastic cord attached to auxiliary eyes on the elastic cord, and a pulley over which the non-elastic cord is passed. With this apparatus a greater variety of movements can be accomplished than is possible with most elastic cord machines.

HAND-TOOL FOR FORMING STUD-SPIRALS.—SIDNEY H. HART, Houston, Tex. Within the ferruled handle of this tool, a slotted tube extends. A detachable shaping-head is provided which has a recess in its under face for the outward passage of the wire. There are also means for holding the shaping-head stationary on the handle. After the wire has been put in place, it is bent at right angles to the ferrule of the handle. The shaping-head is then adjusted over the tube so that the recess is brought over the wire. The handle of the tool is now grasped, the outer end of the wire being held by a pair of pliers, and is turned so as to cause the wire on the shaping-head to be twisted around the head until the desired number of coils has been obtained.

DRAWER-GUIDE.—THORVALD HANSON, Eau Claire, Wis. This invention provides a novel, simple means for taking up lateral looseness resulting from shrinkage or wear. With the frame and the drawer slidable therein are connected two L-shaped guide strips loosely disposed on the frame. At the front of the frame are two short adjusting-screws; the frame also having two diagonal adjusting screws. The four screws have threaded engagement with the guide-strips. When the drawer has shrunk, an adjustment of the screws will effect a correction by acting on the guide-strips. Should the drawer bind, the reverse adjustment is effected.

MANUFACTURE OF STONE FROM KIESELGUHR.—CARL GRUENZWEIG, Ludwigshafen, Germany. The inventor of this process has devised a means of manufacturing, from infusorial earth, a light artificial stone similar to cork in its specific gravity and in being a bad conductor of heat, but having an advantage over cork in its ability to withstand high temperatures. The process consists in preparing a dope of infusorial earth, clay, and finely divided cork. The dope is heated, whereby the cork is burned, thus leaving interstitial air-spaces.

GAME APPARATUS.—EDWARD K. GRIESEMER, Reading, Pa. The apparatus consists of a board provided with a series of ribs forming a number of radial chambers. In connection with the board a number of balls are employed. In playing the game a player endeavors to roll a ball in each chamber, and one in the center of the board, the balls having all been previously assembled in the marginal gutter formed by the ribs.

MILKING-STOOL. — ANDREW DAHLSTROM, Big Rapids, Mich. The stool is provided with an oblong seat to which legs are secured. Near one end of the seat an opening is made to receive the milk-pail. The inclined surfaces of the opening are unequally beveled in order that the pail may be more readily placed in a vertical position when nearly filled. The pail, even when filled, will not disturb the equilibrium of the stool, should the milker rise from his seat.

NAME-PLATE.—WILLIAM H. CLARK and LLEWELLYN J. WATTSON, San Francisco, Cal. This name-plate is primarily designed to be applied to pews, and is so constructed that while a base and a display member are employed, which are adapted for locking engagement, no means are visible whereby the two parts may be disconnected. The invention provides a durable construction for locking name-plates and means whereby the members of the plates may be disconnected by a key, without the necessity of the keyhole's appearing at the front of the plate.

ROOFING-TOOL.—ALBERT DANZER, Hagerstown, Md. In applying tin roofing to buildings, not only is the nailing of the numerous hook-clips into the sheathing a tedious operation; but as the nails have to be held in the fingers while being driven, the work is rendered doubly difficult. This invention provides a special tool for nailing the hook-clips so that the hands cannot be injured. The tool comprises a tubular shank having near its lower end downwardly projecting lips adapted to rest on the top of the standing flange of the roofing-sheet. A chute leads into the central passageway of the shank, and receives and guides the nails. A reciprocating driver plays in the passageway and, when brought down, sinks the nail into the sheathing.

Designs.

MATCH-BOX.—JACOB A. MOLLER, JR., Manhattan, New York city. The leading feature of this design consists in the novel decoration provided. On one side the box is ornamented with the figure of a Norseman, and on the other side with a Viking ship.

STAIR-CORNER GUARD.—FRANK D. GOODWIN, Bangor, Me. The guard comprises a triangular plate, with beveled edges, and a circular projection whereby the plate is held in place. The guard is primarily designed to prevent the accumulation of dust in the corners.

HOOK FOR SHOE-LACES.—MORRIS H. LIPMAN, Manhattan, New York city. The hook consists of a loop-shank and a single shank, continuous with the loop-shank. The single shank has one member returned in the direction of the loop-shank. The hook is designed to be used in connection with a lace patented by the same inventor, the object of the combined use being to provide a more ready means of disengaging a lace from the shoe than has heretofore been customary.

CLIP.—ANDREW C. NYGAARD, Rawlins, Wyo. The body of this clip is L-shaped in general contour and comprises an upright member and a horizontal member, the upright member being provided with a semicylindrical offset. The clip is designed to be attached to a vehicle, and by reason of its peculiar construction, offers means for the attachment of sled-runners, for the raising and lowering of these runners, or for the raising and lowering of wagon-wheels.

BOTTLE.—CHARLES H. FRANCISCO, Brooklyn, New York city. The body of the bottle is polygonal in form and has its edges serated. The bottle is designed to contain poison. A person feeling for a medicine bottle in the dark, will immediately perceive by the jagged edges that this particular bottle contains poison, and is hence forewarned.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

PETROLEUM MOTOR CARS. By Louis Lockert. New York: D. Van Nostrand Company. 1898. Pp. 218. Illustrated. Price $1.50.

There is no question that the motor car has come stay, and the only question which now arises is as to the type of motive power. This is governed somewhat by conditions, such as nearness to a city, to available power, etc. A motor carriage is an expensive affair, although it is much more economical in the end than a carriage hauled by a horse. But no mistake should be made in purchasing a motor carriage, so it is well for prospective purchasers to be well posted upon what has been done up to the present time. The volume before us deals only with petroleum motor cars, which, together with electric motor cars seem to have the entire field to themselves. There is a large amount of matter in the present volume which will interest all who are in any way engaged in designing motor carriages, and the book will, doubtless, be warmly welcomed by them.

COMMERCIAL ORGANIC ANALYSIS. Vol. II. Part I. By Alfred H. Allen, F.I.C., F.C.S. Philadelphia: P. Blakiston, Son & Company. 1899. 8vo. Pp. 387. Price $3.50.

We already had great pleasure in reviewing two volumes of this most important work. The volume before us is what is known as Volume II., Part I., and while we regret the necessity for not numbering the volumes in regular order, at the same time it does not interfere with the value of the book. The present volume deals with fixed oils, fatty waxes, glycerol, nitroglycerine, and nitroglycerine explosives. We do not know of any book on the subject which is so valuable as Allen's series, which will include eight volumes in all. We are inclined to consider that the series, when complete, will form a library of books which will become classic; for, while methods in chemistry are constantly changing, at the same time the broad principles which underlie them are stable. It should be understood that the Blakiston editions of Allen's books are the only authorized editions, which have been revised by the author. The author does not approve of the spelling advised by the American Association for the Advancement of Science. It has not been adopted in the book. This has resulted in giving the book a far more artistic appearance than can be given by the ugly and uncouth spelling which it has been attempted to force down our throats.

THE CENTRIFUGAL PUMP. Turbines and Water Motors, including the Theory and Practice of Hydraulics. By Charles H. Innes. Manchester, England: Technical Publishing Company, Limited. New York: D. Van Nostrand Company. 1898. Pp. 229. 183 illustrations.

The volume before us is of great value to the engineer, treating mathematically of the problems which confront him when he is called upon to deal with centrifugal pumps, turbines, or water motors. The book will also be of great use to the draftsman and designer in their respective professions. The illustrations are numerous, well chosen, and most of them are on a fairly large scale. The only thing we have to criticise the book for is the lack of an index, which is most exasperating. We will welcome the time when English technical publishers will see the necessity of providing every book with an adequate index.

GAS AND PETROLEUM ENGINES. Translated and adapted from the French of Henry de Graffigny. Edited by A. G. Elliott. London: Whittaker & Son. New York: Macmillan Company. 1898. 16mo. Pp. 140. 52 illustrations. Price 75 cents.

There is already a considerable literature upon gas engines, but there always seems to be room for a practical book upon the subject. It does not compare with other English and American books on the subject, but will doubtless be of interest to the beginner.

LIGHTING BY ACETYLENE. Generators, Burners, and Electric Furnaces. By William E. Gibbs, M.E. New York: D. Van Nostrand Company. 1898. 12mo. Pp. 161. Illustrated. Price $1.50.

The volume before us is the second edition, revised and enlarged. The fact that a second edition has been called for in less than a year shows conclusively that the public is more than ever interested in the new illuminant, and literature on the subject in book form is very limited, and the result is that the present volume will be welcomed by many who will find that it will assist them in solving the somewhat difficult problems which now confront them. Illustrations of the latest forms of generators are given. The second edition is a decided improvement over the first.

YEAR BOOK FOR COLORISTS AND DYERS. Presents a Review of the Year's Advance in the Bleaching, Dyeing, Printing, and Finishing of Textiles. By Harwood Huntington. Wool Exchange Building, New York. 1898. 12mo. Pp. 309. Price $5.

There is very little literature in the English language to which a color chemist can refer and find the information he requires the oftenest. The author is an expert color chemist, of New York city, and is, therefore, particularly qualified to deal with the subject. He intends to produce a yearly volume. While we are not particularly familiar with either the chemistry or the technical art of dyeing, we can say that the book is of great value to all who are in any way interested in the textile industries, giving, as it does, a glossary and abstract of patents, new dyes, new books, and what the author is pleased to term "sundries," which is by no means the least valuable part of the book. The part relating to dye analysis is a most important one, as well as the alphabetical list of dyes, giving agent and dyeing method. Reference to the book is rendered easy by an excellent index. We have no hesitation in saying that it is a valuable contribution to a much neglected portion of technical literature.

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Marine Iron Works. Chicago. Catalogue free.

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Gasoline Brazing Forge. Turner Brass Works, Chicago.

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Handle & Spoke Mchy. Ober Lathe Co., Chagrin Falls, O.

Schwaab Stamp & Seal Co., Milwaukee. Send for cat'g.

Machinery designed and constructed. Gear cutting. The Garvin Machine Co., Spring and Varick Sts., N. Y.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

For Sale or on Royalty.—United States patent on kitchen and laundry table. Valued at $10,000. For information apply to John F. I. Conway, No. 1210 Green Street, Portsmouth, Va., or Edgar Tate Company, No. 245 Broadway, New York City.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Minerals sent for examination should be distinctly marked or labeled.

(7611) A. W. S. asks: Which is the best or most economical for a toy motor—four cells of gravity battery or two cells of Sampson battery, now used for electric bells? I have both in use now, one for telegraph and the other for electric bell, and would like to know which will be best to attach motor to. Also say whether it is best to leave a gravity battery on closed circuit or open, when not in use. A. The gravity battery is best for motor work, the Sampson for ringing bells. This is because the gravity is a closed circuit battery and the Sampson an open circuit battery. Neither can be used in place of the other. The liquids of the gravity would soon be mixed if left on open circuit, and on closed circuit the Sampson battery would soon be worthless by polarization.

(7612) W. T. H. asks: Why is it that heavy thunder and lightning strokes are so common in the Western States in winter, even during snow storms, when such are never known in the South Atlantic States, except perhaps during one of those electrical storms that occasionally traverse the continent? I lived thirty years in the State of Georgia, and never knew or heard of lightning striking an object, and rarely ever heard thunder in winter, never when very cold. I have lived in Arkansas thirty-three years, where lightning strokes and heavy thunder are almost as common in winter as in summer. A. Answer by H. E. Williams, Acting Chief United States Weather Bureau, Department of Agriculture: So far as known, thunderstorms and lightning are not as prevalent in winter as in summer in any part of the United States. The statistics that have been collected on the subject show that the States most liable to winter thunder storms are Louisiana, Texas, and portions of Arkansas and Mississippi. In this region, however, winter thunder storms form less than ten per cent of the annual number of such storms. The statistics of thunder storms reported by the Weather Bureau observers during 1898 in Arkansas and Georgia, respectively, are as follows: Number of days with thunder storms in Arkansas, 178, of which number 21 occurred in the winter months; number of days with thunder storms in Georgia, 158, of which number 20 occurred in the winter months. If your correspondent has access to the Chronicle Fire Tables, he will find that the number of fires caused by lightning in Georgia is about as large as the number in Arkansas. The subject of winter thunder storms has not been closely studied. We are under the impression, however, that the danger of lightning stroke is equally probable in all parts of the country in which such thunder storms occur.

(7613) M. W. asks: How much CO_2 gas is required to saturate 31 gallons of water at 2° C. and atmospheric pressure, and 31 gallons of water at 2° C. and 6 pounds extra pressure, and 31 gallons of water at 9° C. and 7·5 pounds extra pressure? Also please state formula, how to figure above problems. A. At atmospheric pressure and at ordinary pressures, water will absorb about its own volume of CO_2 gas, forming a solution with a specific gravity of 1·0018. The weight of gas dissolved at other pressures varies nearly in the same proportion as the pressures. The effect of temperature upon the amount of CO_2 dissolved is this: The higher the temperature, the less gas is held in solution until, when the boiling point is reached, all the gas is driven off. The volume of CO_2 which water will absorb under a pressure of one atmosphere for various temperatures is as follows: At 0° C., 1·7697 volumes; at 2°, 1·6481 volumes; at 8°, 1·2869 volumes; at 10°, 1·1847 volumes. These results are from experiments, and no formula is required. At 2° C. and 1 atmosphere 1·7697×31 gallons will be dissolved. At 9° C. and one-half atmosphere, ½×1·2358×31 gallons will be dissolved.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted MARCH 7, 1899,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising apparatus, L. W. Yaggy	620,689
Advertising device, H. A. Goebler	620,868
Air compressor, H. E. Anderson	620,822
Air supplying apparatus, F. A. Baynes	620,830
Alarm. See Overflow alarm.	
Amido malonic ester and making same, R. Blank	620,562
Amido malonic esters, obtaining indoxylic compounds of, R. Blank	620,563
Animal trap, T. H. Donlon	620,753
Annunciator, S. B. Fowler	620,577
Atomizer, J. A. Everitt	620,576
Axle box, roller, A. Robinson, Jr	620,673
Back pedaling brake, H. L. Bailey	620,631
Bait box, A. B. Russ	620,805
Battery. See Electric battery. Storage battery.	
Bed, invalid, J. Powley	620,800
Bedstead fastening, Reigart & Boll	620,611
Beehive outer case, J. N. Taylor	620,859
Bell door knob, Kinnaman & Flowers (reissue)	11,721
Belt fastener, R. Fraser	620,765
Bicycle dress guard, G. T. Heineke	620,651
Bicycle driving gear, N. K. Peoples	620,797
Bicycle frame joint, Belcher & Easom	620,833, 620,834
Bicycle handle bar, adjustable, M. H. Vanevera	620,684
Bicycle holder, C. Mee, Sr	620,714
Bicycle lock, M. F. Cunningham	620,700
Bicycle rack, H. L. Wilcox	620,863
Bicycle saddle, W. S. Upson	620,620
Bicycles, convertible breast and back rest for, J. Wood	620,688
Bog cutter, A. Anderson	620,559
Boiler. See Steam boiler.	
Boiler, K. Park	620,872
Boiler flue cleaner, J. C. Ogletree	620,608
Boiler flue cleaner, D. Raso	620,670
Bolt. See King bolt.	
Book back lettering machine, A. Von Auw	620,622
Boring machine, Rockwell & Gerlach	620,614
Bottle or jar stopper, F. McCarty	620,663
Bottles, protecting cover for, W. A. Mauran	620,850
Box. See Bait box. Folding box. Meter box.	
Bracket. See Gas bracket.	
Brake. See Back pedaling brake. Vehicle brake.	
Brake mechanism, H. Tesseyman	620,724
Bran duster, J. Warrington	620,860
Brick press, S. Taylor	620,809
Building partition, E. Ketchum	620,594
Burner. See Hydrocarbon burner. Oil burner. Vapor burner.	
Bushing and stopper, faucet, R. Piotrowski	620,798
Butt adjuster, D. Sincock	620,858
Cabinet, manuscript, A. A. Hoskin	620,777
Cables, splice for old wire, P. T. Christensen	620,739
Can heading machine, R. D. Hume	620,653
Cans, double rim for paint, M. F. Hartnett	620,771
Cap, C. J. Holzenthaler	620,776
Car coupling and train pipe coupling mechanism, combined air operated, J. S. Bubb	620,564
Car fender, G. W. Donning	620,573
Car fender, R. W. Gibson	620,581
Car, railway, W. F. Richards	620,803
Car step, S. Oliger	620,666
Carbureter, W. S. Filley	620,646
Carbureter, J. Henderson	620,586
Carbureter, C. N. Lippitt	620,595
Carpet fastener, L. Kern	620,782
Carrier, C. J. Chadwick	620,694
Chuck, drill, H. M. Reynolds	620,612
Cleaner. See Boiler flue cleaner. Pen cleaner.	
Climber, C. H. Cole	620,741
Clipper, hair, A. M. Sims	620,617
Clock, electric, J. Butcher	620,864
Combing machine for textile materials, E. Delette	620,747
Cooking utensil, J. A. Dion	620,750
Corn compressor or binder, H. A. Horton	620,869
Coupling. See Hose coupling. Shaft coupling. Thill coupling.	
Crate, knockdown, G. T. McGlaughlin	620,607
Cream separator, centrifugal, D. T. Sharples	620,722
Cultivator shovel, J. T. Smith	620,618
Cultivator spring trip, J. P. Moore	620,717
Curtain hanging apparatus, P. G. Goldsmith	620,648
Cutter. See Bog cutter.	
Cutter setting gage, S. S. Farney	620,760
Cycle driving wheel, W. H. Chapman	620,737
Cycle frame, J. MacKenzie	620,787
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Dredging machine, J. J. Batman	620,635
Drier. See Fruit drier.	
Drill. See Rock drill.	
Dye, black trisazo, Elbel & Oppermann	620,574
Dyeing, J. W. Fries	620,578
Dyeing textile fabrics, machine for, J. W. Fries	620,579
Elastic band, L. Nissim	620,664
Electric battery, thermochemical, M. L. Severy	620,855
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Electric heater, R. A. Parker	620,720
Electric switch, Bernardini & Ely	620,839
Electrical conductor connector, P. Minich	620,715
Electrical regulator, W. H. K. King	620,783

(Continued on page 174)

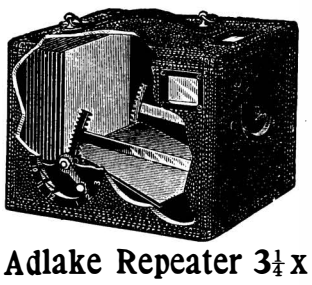
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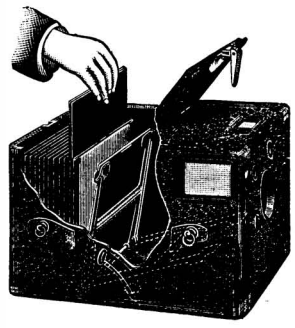


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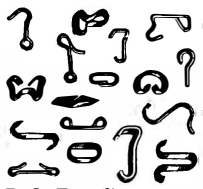


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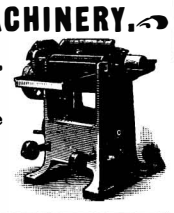
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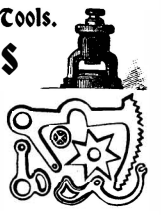
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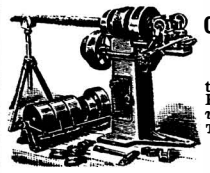
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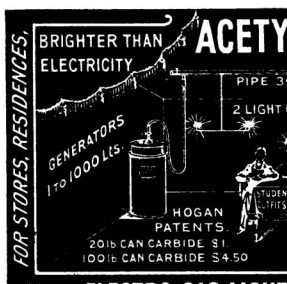


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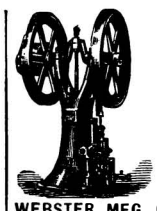
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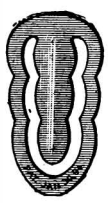
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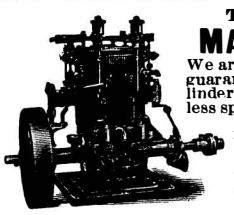
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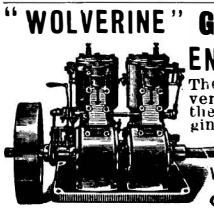
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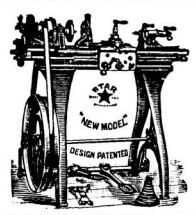
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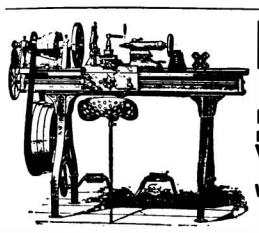
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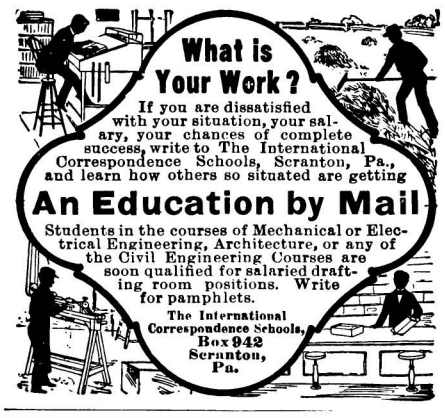


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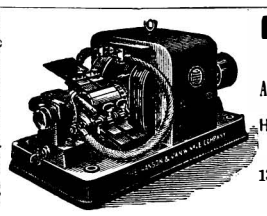
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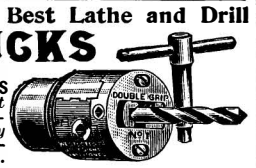
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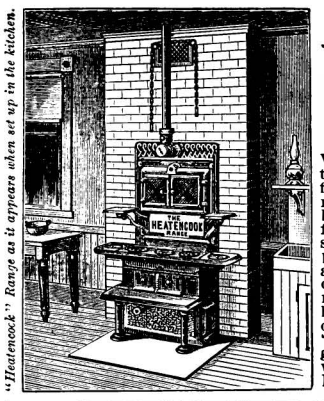
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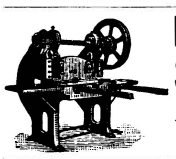
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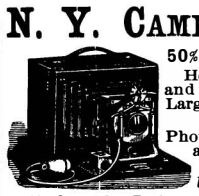
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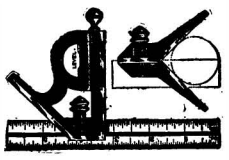
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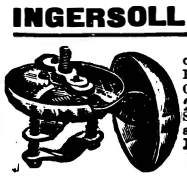
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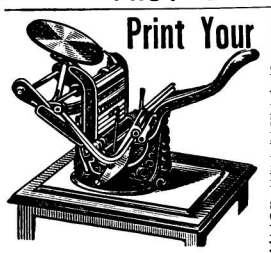


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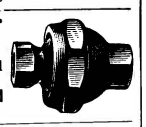
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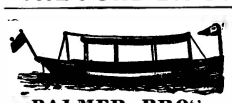


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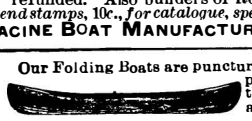
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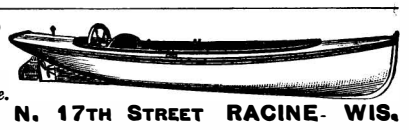
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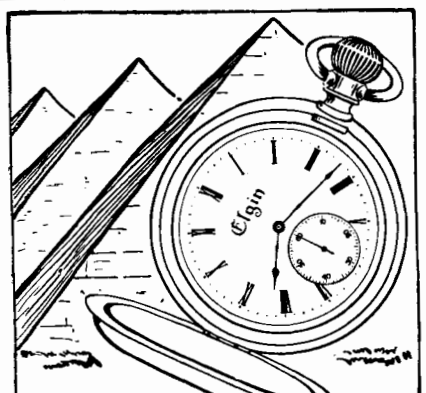


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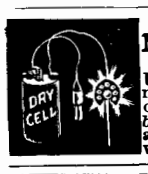
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DESIGNS.

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Badge, L. L. Whittemore	30,304
Bolt, king, M. L. Senderling	30,319
Cabinets, dispensing front for grocers', F. F. Jaques	30,325
Cup, H. M. Williams	30,308
Dictionary holders, standard for, L. W. Noyes	30,311
Eyeglass case, W. Zoerb	30,307
Fastener socket member, W. S. Richardson	30,315
Fire pot lining section, J. W. Kennedy	30,317
Game standard, H. R. English	30,310
Generator shell, E. P. Waggoner	30,320
Hat supporting band, R. A. Bliss	30,327
Inhaler, J. M. Munyon	30,312
Kaleidoscope standard, G. Wale	30,309
Lock case, P. Rodgers	30,314
Mattress frame, G. E. Camp	30,326
Pan or plate lifter, R. N. Roach	30,316
Pin, etc., stick, A. A. McRae	30,305
Pipe, drain, J. G. Furlow	30,318
Spoons, forks, etc., handle for, S. H. Manchester	30,306
Staple puller and wire stretcher, H. F. Austin	30,322
Staple pulling implement, W. E. Lanning	30,323
Syringe nozzle, C. E. Gray	30,313
Tool holding block, M. Smith	30,321
Vehicle bolster plate, M. L. Senderling	30,324

TRADE MARKS.

Ale, sugar-free pale, J. C. Harvey	32,572
Cement, Portland, Portland Cementfabrik Hemmoor	32,582
Cements, bicycle, B. Nusbaum	32,581
Coin controlled mechanism, Caille-Schiemer Company	32,567
Cordials, herb bitters, and liquors, Oberhaeusser & Landauer	32,573
Cyanid of potassium, British Cyanides Company	32,578
Disinfectants, certain named, Zenner-Raymond Disinfectants Company	32,580
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Liniments and lotions for certain named diseases, S. D. Villette	32,575
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Oats, compressed rolled, Akron Cereal Company	32,568
Oil, olive, Seville Packing Company	32,570
Poisons for animals, certain named, L. C. Wedgefuth	32,579
Rubber goods, manufactured, Victor Rubber Company	32,565
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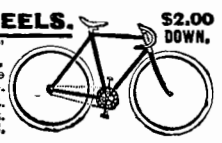
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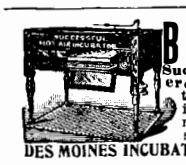
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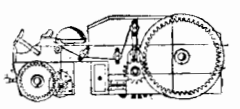


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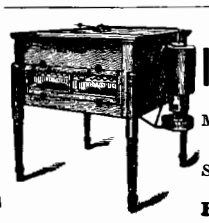


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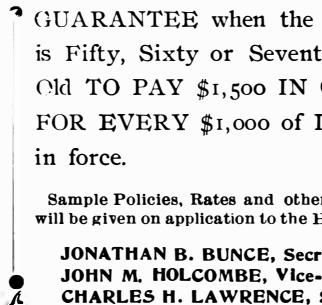


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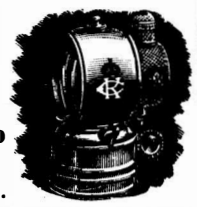
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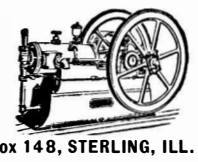
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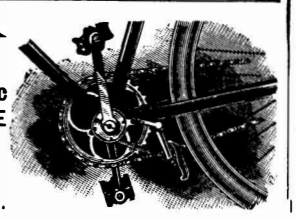
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